NUCLEAR SCIENCE ABSTRACTS

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CORRECTION

NSA Vol. 13, No. 18A, p. 2162. In abstract 16096, Nuclear Eng. should be Nuclear Power.

The category "Patents" has been discontinued, and abstracts of patents are now being categorized according to the subject content. References in the Subject Index to abstracts of patents will continue to be identified by the letter "P." Patent numbers are included in the Report Number Index.

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 23 December 15, 1959

GENERAL

20764 HMI-B5

Hahn-Meitner-Institut für Kernforschung Berlin. ZWEITER JAHRESBERICHT 1958. (Second Annual Report 1958.) July 1959. 68p.

The Second Annual Report of the Hahn-Meitner Institut für Kernforschung reports on the completion of the construction of the nuclear chemistry section, the startup of the reactor, and the initiation of research work in these sections. The activities of the general management and the library are indicated. The publications and internal reports by members of the Institut are tabulated. (J.S.R.)

20765

THE DIFFUSION IN THE ATMOSPHERE OF A HEAVY NON-HOMOGENEOUS ADMIXTURE FROM AN INSTANTANEOUS POINT SOURCE. A. Ya. Pressman (Inst. of Applied Geophysics, Academy of Sciences, S.S.S.R. Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 3, 78-87(1959) Mar. (In Russian)

The effect of the non-homogeneity of air pollution particles on their propagation in the turbulent atmosphere and fall-out onto the earth's surface ($z = 0$ plane) is considered. The initial Stokes' velocity distribution of aerosol particles in an instantaneous point source, elevated on an H-level, is set as two-parametrical δ-shaved function N(w). Vertical propagation of particles is considered as simple falling, and vertical diffusion is neglected. Accordingly, the equation of two-dimensional diffusion in horizontal directions is solved. Expressions for volume and surface concentration of particles are obtained. For some cases the X_{max} position on the $z = 0$ plane of the surface concentration maximum is calculated. (auth)

20766

THE USE OF RADIOACTIVE ISOTOPES FOR THE INVESTIGATION OF SEWAGE TREATMENT PLANT. Stanley Grove Burgess and Arthur Frederick Green (Public Health Dept., London). J. Brit. Nuclear Energy Conf. 4, 217-29(1959) July.

The use of radioactive tracers in full-scale investigations on sewage tanks is reported. The advantages and disadvantages of the use of radioactive materials as tracers are discussed and a description of the equipment selected for various methods is given. An experiment on a longitudinal re-aeration channel of an activated sludge plant is described, in which the tracer was used to determine the mean retention time of the activated sludge in the channel. Details are given of an experiment carried out in a circular final settling tank, in which the radioactive material was used to label the activated sludge selectively from the supernatant liquid. In this way it was possible to assess the rate of removal of sludge from the tank. A series of experiments in large rectangular primary sedimentation tanks is described. Mean retention times at various rates of throughput were determined and were found to be considerably less than the theoretical. The flow over the inlet and outlet weirs of the tank was examined, and was found to be reasonably uniform. A comparison was made between the two halves of an interconnecting tank, with common feed, and showed the distribution to be uniform. A survey was made from end to end of the tank, in an attempt to plot the pattern of movement within the tank and considerable success was attained. The forward movement of the sewage stream in the tank was also measured, and was found to be unexpectedly high. (auth)

20767

THE ARGUS EXPERIMENT. N. C. Christofilos (Univ. of California, Livermore). J. Geophys. Research 64, 869-75(1959) Aug.

A geophysical experiment on a global scale was conducted last fall. Three small A-bombs were detonated beyond the atmosphere at a location in the south Atlantic. The purpose of the experiment was to study the trapping of the relativistic electrons (produced by the β-decay fission fragments) in the geomagnetic field. The released electrons are trapped by this field oscillating along the magnetic lines between two mirror points. In addition to this motion the electrons drift eastward, creating a thin electron shell around the earth. The lifetime and location of the thus-created global electron shell were measured by satellite- and rocket-borne instruments. Auroral luminescence was observed at the conjugate points. The electron shell exhibited remarkable stability during its lifetime. No motion of the shell or change in its thickness was detected. The usefulness of such electron shells for interpreting geophysical phenomena and possible future experiments are discussed. (auth)

20768

SATELLITE OBSERVATIONS OF ELECTRONS ARTIFICIALLY INJECTED INTO THE GEOMAGNETIC FIELD. James A. Van Allen, Carl E. McIlwain, and George H. Ludwig (State Univ. of Iowa, Iowa City). J. Geophys. Research 64, 877-91(1959) Aug.

Four radiation detectors in satellite 1958 (Explorer

IV) observed geomagnetically trapped electrons resulting from three high-altitude nuclear detonations Argus I, II, and III. An account of over 160 satellite passes through the three Argus "shells" is given, and a preliminary appraisal of the geophysical significance of these experiments is offered. (auth)

20769

PROJECT JASON MEASUREMENT OF TRAPPED ELECTRONS FROM A NUCLEAR DEVICE BY SOUNDING ROCKETS. Lew Allen, Jr., James L. Beavers, II, William A. Whitaker, Jasper A. Welch, Jr., and Roddy B. Walton (Air Force Special Weapons Center, Kirtland AFB, N. Mex.). J. Geophys. Research 64, 893-907 (1959) Aug.

Solid-propellant rockets were sent to altitudes of 800 km from three stations in the eastern United States to observe electrons injected into the geomagnetic field from a small high-altitude nuclear detonation. The electron flux was measured by an assembly of Geiger counters. Shortly after a nuclear detonation above the south Atlantic, a narrow region of high counting rate was observed. The geometry of the observations is related to the geomagnetic field. The region consisted of an intense band about 20 km wide (half-width at half maximum counting rate) and less intense wings extending at least 700 km north and perhaps 700 km south of the band. Neither position nor width of the band changed during the observations, which consisted of periodic soundings until 100 hr after the nuclear detonation. The intensity of both the wings and the band decayed during the measurements as 1/t, which is consistent with the hypothesis that small-angle scattering is the dominant loss mechanism. The angular distribution of the radiation was measured, and the electron flux was observed to be confined very nearly to a plane perpendicular to the field lines. Spectral measurements show far fewer electrons above 4 Mev than were expected from the fission beta spectrum. Betas trapped from the decay of neutrons emitted from large-yield high-altitude weapon tests in the Pacific were also noted. (auth)

20770

THEORY OF GEOMAGNETICALLY TRAPPED ELECTRONS FROM AN ARTIFICIAL SOURCE. Jasper A. Welch, Jr. and William A. Whitaker (Air Force Special Weapons Center, Kirtland AFB, N. Mex.). J. Geophys. Research 64, 909-22(1959) Aug.

A theoretical formulation was made for the history of an artificial shell of geomagnetically trapped electrons resulting from low-yielding nuclear detonations in the exosphere. The formulation assumes a source distribution and gives the spatial distribution of trapped electrons along the magnetic field lines, the drift rate around the world, and the configuration of the resulting shell. Interactions of the shell with the atmosphere lead to an electron density decaying inversely with time from injection for times longer than a characteristic lifetime that is a function of altitude and electron energy. The electron flux is found to be very nearly confined to a plane perpendicular to the field direction after several characteristic lifetimes. Scattering by geomagnetic fluctuations is probably not an important loss mechanism for the artificial shell, but it may be important for the hard component of the natural trapped belt. The effect of the geomagnetic anomaly over the south Atlantic is described qualitatively. Jason rocket data and Explorer IV satellite data were compared with the theoretical results. (auth)

20771

OPTICAL, ELECTROMAGNETIC, AND SATELLITE OBSERVATIONS OF HIGH-ALTITUDE NUCLEAR DETONATIONS, PART I. Philip Newman (Air Force Cambridge Research Center, Mass.). J. Geophys. Research 64, 923-32(1959) Aug.

After each of the high-altitude detonations in the Argus experiment, visual auroras were observed in the detonation area. After the third event an aurora was observed in the conjugate area. After the second and third events, signals attributed to hydromagnetic waves were detected in the conjugate region; these signals had a periodicity of about 1 cycle per second. The maximum change in the magnetic field was about 1 gamma. If propagated along the magnetic line of force the velocity was about 2000 km/sec. Sporadic E was observed after the third event in the conjugate area. Comparative records of the 5577 and 3914 A lines were obtained in the detonation area. (auth)

20772

OPTICAL, ELECTROMAGNETIC, AND SATELLITE OBSERVATIONS OF HIGH-ALTITUDE NUCLEAR DETONATIONS, PART II. Allen M. Peterson (Stanford Univ., Calif.). J. Geophys. Research 64, 933-8(1959) Aug.

The radio effects of the Argus detonations were measured using 30-Mc radars designed to obtain echoes from the aurora or from the earth's surface mirrored in an enhanced ionospheric layer, VLF receivers for monitoring distant transmitters or atmospheric noise sources in search of changes in signal strength, riometers for recording cosmic noise absorption of VHF shot-created noise at 30, 60, and 120 Mc. Results included auroral echoes in the vicinity of the launch point after all three shots and near the conjugate points after the first and third shot, sudden depressions of 6 to 12 db of the signal from England (19.6 kc) at Madrid and the Azores, and no ionospheric absorption at the conjugate location. (auth)

20773

AURORAS, MAGNETIC BAYS, AND PROTONS. R. C. Bless, C. W. Gartlein, D. S. Kimball, and G. Sprague (Cornell Univ., Ithaca, N. Y.). J. Geophys. Research 64, 949-53(1959) Aug.

Various statistical and detailed studies of the relation between auroras and bays are presented. It appears that bays and auroras are manifestations of the same phenomenon. Numerical estimates are presented which indicate that the bay can be caused by atmospheric winds operating on ionized particles produced by incoming 50-kev solar protons. It is not necessary to postulate any dynamo action. (auth)

20774

ANALYSIS OF PHOTOELECTRONS FROM SOLAR EXTREME ULTRAVIOLET. H. E. Hinteregger and K. R. Damon (Air Force Cambridge Research Center, Bedford, Mass.) and L. A. Hall (Comstock and Wescott, Inc., Cambridge, Mass.). J. Geophys. Research 64, 961-9(1959) Aug.

The first rocket experiment for analysis of photoelectrons from a metal surface exposed to solar extreme ultraviolet around 115 miles altitude is evaluated. The soundness of the experimental techniques is confirmed, and the first data on photoelectron energy distribution are presented. Details on the simplified 'photoelectric method' of radiation analysis are dis-

cussed, and the preliminary results of applying this method to the first flight data are given. (auth)

20775

MEASUREMENT OF IONOSPHERIC ELECTRON DENSITIES USING AN RF PROBE TECHNIQUE. J. E. Jackson and J. A. Kane (Naval Research Lab., Washington, D. C.). J. Geophys. Research 64, 1074-5(1959) Aug.

Using an rf probe technique it was found that above 110 km the impedance undergoes only a reactive variation from its free space value. Electron densities obtained by a propagation experiment and the rf probe technique are presented. These electron densities were obtained by a rocket flight July 4, 1957. (C.J.G.)

20776

ECONOMICS OF THE PRODUCTION OF RADIOISOTOPES IN NUCLEAR REACTORS. Pavel Kovanic (Ústav jaderného výzkumu ČSAV, Prague) and Milan Kulka (Tesla Liberec n. p., závod Přemyšlení). Jaderná energie 5, 227-32(1959). (In Czech.)

The possibilities of the production of radioisotopes in thermal nuclear reactors in dependence on the degree of enrichment of fuel and on the design of the reactor are evaluated. Approximate economic evaluation of the production of radioisotopes in different types of reactors on the basis of the number of radioactive nuclei produced, without detailed analysis of specific activities obtained, is made. The most advantageous type of a reactor is a reactor with highly enriched fuel, with removable reflector, with a possibility of changing easily the form of the reactor core, with a great excess of reactivity, and with a great space around the reactor core, which space is either empty or filled with water. (auth)

20777

DEVELOPING RADIATION-RESISTANT LUBRICANTS. H. C. O'Conner (Shell-Mex and B. P. Ltd.). Nuclear Power 4, No. 40, 88-9(1959) Aug.

A description of the tests performed in developing radiation-resistant lubricants is given. Application of the lubricant Shell APL 701 to various components in the butterfly valves of a nuclear power station is discussed. (C.J.G.)

20778

BUILDING THE NUCLEAR NAVY. 1. NAVY MAKES GREAT STRIDES. John E. Kenton. Nucleonics 17, No. 9. 73-81(1959) Sept.

The U. S. Navy's nuclear propulsion program is outlined. Data on reactors and reactor components, dimensions, completion date, and cost are given for 33 nuclear powered ships. (C.J.G.)

20779

1959 ATOMIC INDUSTRY DIRECTORY OF PRODUCTS, EQUIPMENT AND SERVICES. Based on a 1959 Survey of Members of the Atomic Industrial Forum. New York, Atomic Industrial Forum, 1959. 130p. $2.50.

The directory includes only equipment, materials, and services which have their primary application in the nuclear and applied radiation field and are not generally supplied for other industrial applications. A classified index of products, equipment, and services, and an alphabetical listing of organizations with their stated capabilities are given. (W.D.M.)

20780

BIBLIOGRAPHY OF THE STABLE ISOTOPES OF OXYGEN (O^{17} AND O^{18}). David Samuel and Fritz Steckel, comps. and eds. New York, Pergamon Press, 1959. 229p. $7.50.

References to papers published on the stable isotopes of oxygen (O^{17} and O^{18}) up to the end of 1957 are presented, excluding work on nuclear reactions. The references are arranged alphabetically by first author, with cross references from the other authors. A subject index is included. (W.D.M.)

20781

THE MARKET FOR NUCLEAR MATERIALS. II. MODERATORS. A. GRAPHITE. Paris, Organisation for European Economic Co-Operation, 1959. 13p.

The demand for graphite for nuclear purpose is now quite heavy. By 1965 its value should represent about 150 million E. M. A. units of account, and annual demand by about 1965 may amount to the equivalent of about 40 million E. M. A. units. The demand for graphite of nuclear quality will be approximately 150,000 tons from the present until 1965. Present production and price of graphite in Europe are discussed. (C.J.G.)

20782

INTERNATIONAL DIRECTORY OF RADIOISOTOPES. VOLUME 1. UNPROCESSED AND PROCESSED RADIOISOTOPE PREPARATIONS AND SPECIAL RADIATION SOURCES. Vienna, The International Atomic Energy Agency, 1959. 283p. $3.50.

Information is contained on all radioisotopes which are for sale or distribution by the major suppliers in the world. Volume I encompasses complete tables of radioisotopes, including processed and unprocessed isotope preparations, and solid radiation sources for special applications. The most important current physical data, such as half lives and radiations, are given for each isotope. A list of suppliers is given. Price quotations in local currency are converted into US currency for comparison. (W.D.M.)

20783

TOTALLY ENCLOSED CANNED MOTOR PUMP. Benjamin Cametti and Arthur C. Hagg (to Westinghouse Electric Corp.). U. S. Patent 2,887,061. May 19, 1959.

A canned motor pump design is described. The stator is a hermetically sealed one-piece cylinder. The rotor is designed for greater electrical efficiency. The impeller is hollow having a central inlet and an annular discharge. (T.R.H.)

BIOLOGY AND MEDICINE

20784 AD-212768

School of Aviation Medicine, Randolph AFB, Tex. THE BIOLOGICAL AND MEDICAL EFFECTS OF IONIZING RADIATION. II. THE EFFECT OF EARLY EXSANGUINE-TRANSFUSION ON X-IRRADIATED DOGS. Report No. 2. Charles P. Powell and Herbert B. Gerstner. June 1952. 10p. Project No. 21-47-005.

An exsanguino-transfusion method for dogs is described. It enables replacement of 90% of the recipient's blood. The technique was used on 40 dogs (20 controls) within 3 hr of a 420 r whole-body dose of x rays. No significant differences were found in clinical course, most laboratory studies, and survival time. A marked leukocytosis occurred in transfused dogs over a period of 2 days in sharp contrast to the leukopenia of the controls. (T.R.H.)

20785 AECU-4357
Brookhaven National Lab., Upton, N. Y.
TURNOVER OF LABELED AMINO ACIDS AND PROTEINS IN CANCEROUS TISSUES AND MAMMALS. Literature Search. M. Comstock. Oct. 28, 1958. 5p. $1.80(ph) $1.80(mf) OTS.

References relating to turnover of labeled amino acids and proteins in cancerous tissues and mammals are given. The search was made in Current List of Medical Literature, 1950-58, Quarterly Cumulative Index Medicus, 1940-55, and the BNL Library. 62 references. (T.R.H.)

20786 AECU-4358
Brookhaven National Lab., Upton, N. Y.
EFFECT OF PROTON AND DEUTERON IRRADIATION ON BIOLOGICAL MATERIAL. BIBLIOGRAPHY. M. Comstock. Sept. 12, 1958. 2p. $1.80(ph), $1.80 (mf) OTS.

References relating to proton and deuteron radiation effects on biological materials, mammalian tissues in particular, are given. The search was made in Nuclear Science Abstracts, 1948-58, Zentralblatt fur die gesamte Radiologie, 1939-57, and the BNL Library. 17 references. (T.R.H.)

20787 AF-SAM-59-75
Texas. Univ., Austin. Radiobiological Lab.
TOXIC EFFECTS OF S,2-AMINOETHYLISOTHIURONIUM DIBROMIDE. George S. Melville, Jr. and Thomas P. Leffingwell. Mar. 3, 1959. 8p.

The toxicity and pathologic effects of AET-DiBr have been examined in rats. Acute doses have been administered both intraperitoneally and orally. The compound is highly toxic to rats. The chronic effects of AET-DiBr have been examined by means of serial intraperitoneal injections. At low doses, large total amounts of the drug can be tolerated. The acute and chronic effects of sodium chloride, sodium bromide, sodium acetate, and sodium nitrate have been tested. The anions and the cation do not appear to contribute to the toxicity of isothiuronium salts. (auth)

20788 AF-SAM-59-77
Texas. Univ., Austin. Radiobiological Lab.
RADIATION-INDUCED GASTROINTESTINAL DEATH IN THE MONKEY. Stephen G. Wilson, Jr. Mar. 11, 1959. 18p.

Forty-four monkeys irradiated with 1.5 to 7.5 kr of cobalt-60 (gamma) radiation died between 4 and 9 days postirradiation. The greatest percentage of deaths occurred on the 6th, 7th, and 8th days. The mean survival time was 6 days. The most prominent findings at autopsy were gastric and colonic ulceration. Colonic ulceration occurred in 33 of the animals and its incidence was invariant with radiation dose over the dose range tested. Gastric ulceration occurred only 14 times. Its incidence increased as radiation dose increased. This observation was analyzed statistically. Evidence presented suggests that bacteria play a dominant role in the production of gastric and colonic ulceration following supralethal doses of radiation. Severe mucosal atrophy occurred in both the small intestine and colon. It could be divided into four basic types that reflected the severity of cytologic distortion of the epithelial cells, and the degree of epithelial cell regeneration. In the small intestine, the distribution of the lesion types was a function of radiation dose; in the colon the distribution was a function of survival time. The significance of these variations is discussed. (auth)

20789 AFSWP-1087
Naval Medical Research Inst., Bethesda, Md.
PHARMACOLOGICAL STUDIES ON IRRADIATED ANIMALS. VII. PROTECTION OF GUINEA PIGS AGAINST RADIATION-INDUCED MORTALITY BY CELL-FREE MOUSE SPLEEN EXTRACT STORED FOR ONE YEAR. Friedrich Ellinger. Mar. 6, 1959. 5p. (NM 62 04 00.03.02).

Previous observations concerning a protective effect of heterologous cell-free total spleen extracts, i.e., injection of mouse spleen extracts into guinea pigs after their exposure to a lethal dose of ionizing radiation, are confirmed. It is demonstrated furthermore that the active principle remains stable within these crude extracts for a period of one year if the lyophilized extract is stored in a refrigerator. The significance of these observations for isolation and identification of the active principle is discussed, as well as the possibility to use crude spleen extracts for the postirradiation treatment of the acute radiation syndrome. (auth)

20790 BNL-1343
Yale Univ., New Haven. Osborn Botanical Lab. and Brookhaven National Lab., Upton, N. Y.
THE EFFECTS OF FRACTIONATED DOSES OF RADIATION ON CHROMOSOME ABERRATION FREQUENCIES IN TRADESCANTIA MICROSPORES. I. STUDIES WITH X-RAYS. Frederick J. de Serres and Norman H. Giles. [1952]. 21p. $4.80(ph), $2.70(mf) OTS.

Experiments have been performed at a low and a high intensity of x rays on Tradescantia microspores to test the validity of the theory, recently proposed by Lane, that there is an inhibition-recovery sequence in the production of chromosome aberrations with fractionated doses. In both experiments a single dose of 350 r was administered without fractionation, and in two equal parts with intervals of 1, 2, 4, 8, and 12 hours between fractions. The results of "controlled" environmental conditions in the high intensity experiment and "uncontrolled" environmental conditions in the low intensity experiment do not support the inhibition-recovery sequence theory. The results of both experiments support, rather, the original and later work of Sax, that the reduction of chromosome aberrations with rest periods of 4, 8, or 12 hours between fractionated doses does not exceed twice the aberration frequency induced by a single half dose. In none of the intervals tested did the aberration frequency drop significantly below that induced by twice that induced by a single half dose, nor did the experimental data provide evidence for a significant increase in aberration frequency induced with 4 to 12 hours interval between fractions due to a "recovery" in sensitivity to breakage. (auth)

20791 AEC-tr-3843
TOXICOLOGY OF URANIUM. C. Garavaglia. Translated for Oak Ridge National Lab. from Energia nucleare (Milan) 6, 141-6(1959). 14p. $3.30(ph), $2.40(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 12386.

20792 JPRS-L-516-N
THE CHANGE IN THE PHYSICO-CHEMICAL PROPERTIES OF DESOXYRIBONUCLEIC ACID IN TISSUES OF

IRRADIATED ANIMALS. G. P. Toropova and N. V. Yermolayeva. Translated from Med. Radiol. 3, No. 5, 24-9(1958). 9p. $0.50(OTS).

An investigation was made of the chemical composition and physical properties of DNA from nuclei of liver and intestinal wall of rabbits at various stages of radiation sickness. Data or viscosity and optical density are given and discussed. (T.R.H.)

20793

PHYSICAL ASPECTS OF ROENTGEN THERAPY USING WEDGE FILTERS. II. ANALYSIS OF WEDGE FIELD DOSIMETRY. M. Cohen (London Hospital). Acta Radiol. 52, 158-76(1959) Aug.

The essential features of the dose distribution in a two- or three-field wedge arrangement may be extracted in the form of: mean percentage tumor dose, location of a defined "plateau" relative to a base-line, and "hot-spot factor," i.e., maximum skin dose/mean tumor dose. The following variables are studied: angle between wedges, separation of wedges, width of the normal field, width of the wedge field, and the slope and shape of the wedge isodose lines. The results of the analyses can be presented as "dosage tables" which facilitate a rapid choice of configuration in individual cases. (auth)

20794

OXIDATION TO $C^{14}O_2$ AND CONVERSION TO FATTY ACIDS OF C^{14}-GLUCOSE IN LIVERS OF NORMAL, FASTED AND X-IRRADIATED RATS. John G. Coniglio, Deborah L. Cate, Bryant Benson, and Granville W. Hudson (Vanderbilt Univ., Nashville). Am. J. Physiol. 197, 674-6(1959) Sept.

Oxidation of glucose-1-C^{14} and of glucose-6-C^{14} to $C^{14}O_2$ was greater in slices and homogenates of livers of rats given 1000 r total-body x irradiation and fasted 24 to 48 hours than in their nonirradiated fasted controls. The ratio: $C^{14}O_2$ from glucose-6-C^{14}/$C^{14}O_2$ from glucose-1-C^{14} was not altered in homogenates either by fasting or by x irradiation. In liver slices, the ratio was increased by fasting, per se, but was not affected by x irradiation. In rats weighing 350 to 400 gm, hepatic conversion of glucose-1-C^{14} and of glucose-6-C^{14} to fatty acids was greater in the irradiated fasted animals than in nonirradiated fasted controls although the ratio: C^{14}-fatty acids from glucose-6-C^{14}/C^{14}-fatty acids from glucose-1-C^{14} was not affected by irradiation. In rats weighing 160 to 200 gm, no difference in lipogenesis from either glucose-1-C^{14} or glucose-6-C^{14} was apparent between irradiated and control rats. (auth)

20795

THE PHYSICAL ASPECTS OF A CESIUM TELETHERAPY SOURCE. Charles S. Simons, Isadore Lampe, and Howard B. Latourette (Univ. of Michigan, Ann Arbor). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 587-96(1959) Oct.

A 2,000 curies cesium 137 teletherapy source has been designed for use in a theratron. The large source diameter, 1¼ inches, required by the low specific activity of the cesium chloride, 22.4 c/g, made additional collimation a necessity. The low output of the source, 8 trmin. at one meter, forced a change of r/eatment distance from 75 cm. to 50 cm. source skin distance. The electronic equilibrium thickness of tissue equivalent material was found to be 1.4 mm. Percentage depth dose, exposure dose, and absorbed dose rates are given for 22 treatment fields. Comparison of cesium 137 and cobalt 60 isodose curves is made for 3 typical field sizes, with the finding that in general the shapes of the curves are quite similar, but that the cobalt holds a definite advantage over the cesium from the standpoint of its greater depth dose. (auth)

20796

EFFECT OF RADIOGOLD 198 IN THE TREATMENT OF FIBROMYXOSARCOMA WITH CYST FORMATION. Mary C. Morgan, Ethel E. Erickson, George L. Jordan, Jr., George Ellis, and Thomas H. S. Wolever (Veterans Administration Hospital, Houston, Tex.). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 579-603(1959) Oct.

Radiogold 198 has been used in a cystic fibromyxosarcoma of the left buttock. No significant absorption and no deleterious effects were noted. Temporary decrease in the rate of fluid re-accumulation was obtained after the second injection combined with external supervoltage roentgen therapy. (auth)

20797

TRANSSPHENOIDAL DESTRUCTION OF THE HYPOPHYSIS WITH RADIOACTIVE YTTRIUM. R. D. Moseley, Jr., W. M. S. Ironside, Paul V. Harper, and Alice McCrea (Univ. of Chicago). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 604-12(1959) Oct.

The technique of transsphenoidal yttrium 90 implantation of the pituitary gland under biplane fluoroscopic image intensifier control is described. Principles of dosimetry, nuclear chemistry, and surgical and fluoroscopic technique are considered. Preliminary estimates of clinical response are presented; the types of complications and their incidence are discussed. The method promises to be the most innocuous, effective method of hypophyseal ablation. (auth)

20798

THE CREATION OF DEEP CEREBRAL LESIONS BY SMALL BETA-RAY SOURCES IMPLANTED UNDER GUIDANCE OF FLUOROSCOPIC IMAGE INTENSIFIERS (AS USED IN THE TREATMENT OF PARKINSON'S DISEASE). Sean Mullan, Robert D. Moseley, Jr., and Paul V. Harper, Jr., (Univ. of Chicago). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 613-17 (1959) Oct.

The ideal method of creating deep cerebral lesions should be safe, simple, and under rigid control at all times. The lesion should develop slowly so that any undesired change can be detected and arrested at the earliest possible stage. Palladium 109 in the form of a metallic wire 3 mm. long, weighing 2.8 mg. and with an activity of 20 mc produces in brain a necrotic lesion of 5–6 mm. diameter. It is first visible after forty-five minutes application and reaches its maximum size after ninety minutes. With the aid of fluoroscopic image intensifiers and a special needle, this convenient metallic source (Pd^{109}) can be accurately placed in deep cerebral tissues under local anesthesia. The fluoroscopic radiation to which the patient is exposed approximates that of a gastrointestinal examination. Satisfactory alleviation of the tremor and rigidity of Parkinson's disease has been achieved by this method. (auth)

20799

A CRITICAL EVALUATION OF EXTERNAL BODY SURFACE COUNTING IN THE DETERMINATION OF CARDIAC OUTPUT WITH RADIOACTIVE ISOTOPES. Barbara L. Carter, Sigurd E. Johnsen, R. Kenneth

Loeffler, and Martha E. Southard (Temple Univ., Philadelphia). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 618-25(1959) Oct.

The precordial external counting technique for the determination of cardiac output, while clinically desirable, is in fact unsound. Experimental data are presented to confirm this. (auth)

20800

COMBINED RADIATION AND NITROGEN MUSTARD THERAPY IN HODGKIN'S DISEASE AS COMPARED WITH RADIATION THERAPY ALONE. James C. Cook, Kenneth L. Krabbenhoft, and T. Leucutia (Harper Hospital, Detroit). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 651-7(1959) Oct.

A total of 392 cases of Hodgkin's disease was treated at Harper Hospital from 1922 through 1957. Of these, 347 were suitable for long term follow-up study. The absolute survival rates are presented in five year series from five years to thirty years. A special group of 212 cases (1941 to 1952), approximately one-half of which was treated by roentgen therapy alone and the other half by a combination of roentgen therapy and nitrogen mustard, is analyzed in detail. The fact that an almost equal absolute five year survival rate was observed in each group is interpreted as indicating an advantage of the combined method, since this was used only in cases of generalized involvement. The increased three year survival rates, the longer average monthly survivals of deceased patients and the lower first year mortality rate are additional observations in support of the more beneficial value of the combined method as compared to roentgen therapy alone. In those cases where the combined method was used for the treatment of recurrence, worthwhile further remissions have been produced. (auth)

20801

INCIDENCE OF NEOPLASIA AFTER IRRADIATION OF THYMIC REGION. Howard B. Latourette and Fred J. Hodges (Univ. of Michigan, Ann Arbor). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 667-77(1959) Oct.

From 1932 to 1951 the thymic region of 958 patients was irradiated. The dosage used was relatively low. Information on the subsequent course of 867 is known. Of this group 99 are dead. Two patients developed a lymphoblastoma, one, leukemia and one, lymphosarcoma. This incidence of lymphoblastoma is somewhat higher than might be expected but not significantly so. One patient developed thyroid carcinoma which constitutes a statistically significant increase in the expected incidence rate. These findings are further suggestive evidence of some increase in the incidence of neoplasia after the irradiation of the thymic region. (auth)

20802

THE SIGNIFICANCE OF THE TUMOR BED REACTIONS IN THE RADIATION TREATMENT OF MALIGNANT TUMORS. Halvor Vermund (Univ. of Wisconsin, Madison). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 678-87(1959) Oct.

Inbred mice of the Bittner Z and ZBC strains have been used to study the effects of roentgen radiation on transplanted mammary carcinoma and the tumor bed. Irradiation of the tumor bed before transplantation of fresh untreated tumor resulted in retarded tumor growth and delayed onset of palpable tumor nodule. The irradiated animals lived longer than the unirradiated controls but irradiation of the tumor bed alone did not prevent the tumors from growing and all the mice eventually died with large tumors. The dose which caused the optimal effect was 3,000 r. Irradiation after the transplantation with dose levels up to 6,000 r failed to eradicate the tumors when the time interval between the transplantation and the roentgen treatment was more than three weeks. Irradiation within two weeks after the transplantation resulted in permanent inhibition of the tumor growth in close to 70 per cent of the animals. In the remaining 30 per cent, the tumors developed after a long latent period which in some mice extended over more than one year. Tumors growing slowly in an irradiated bed showed similar uptake of radioactive phosphorus into the desoxyribonucleic acid isolated from the tumors as found in the nonirradiated controls. Irradiation of tumor tissue suspended in physiologic saline in vitro failed to prevent tumor growth upon subsequent transplantation into nonirradiated animals and was less efficient than in vivo roentgen treatments given a short time after the transplantation. In vitro irradiation was slightly more efficient than roentgen treatment of the tumor bed in inhibiting tumor growth. In view of these experimental data, the significance of the tumor bed and the host reactions in radiation treatment of malignant tumors have been discussed. (auth)

20803

THE COMBINATION OF OXYGEN AND OPTIMUM FRACTIONATION IN RADIATION THERAPY OF ADENOCARCINOMA. Lucille A. Du Sault, William R. Eyler, and Glen D. Dobben (Henry Ford Hospital, Detroit). Am. J. Roentgenol. Radium Therapy Nuclear Med. 82, 688-92(1959) Oct.

The results of irradiating spontaneous mammary adenocarcinoma in C_3H mice at the rate of 2,000 r per week to totals of 6,000 r or 8,000 r can be improved by allowing the mice to breathe 95 per cent oxygen and 5 per cent carbon dioxide during treatment; however, the advantage of breaking the total dose into fractions given three times a week as compared to daily treatment is still apparent. Although skin reactions appear to be the same, systemic effects, as measured by number of mice dying before completion of the treatment series, are increased by the gas mixture. These can be minimized by keeping the time of breathing it as short as possible. (auth)

20804

IMMEDIATE POST-EXPOSURE PERMEABILITY CHANGES, AND SOME LATER RESPONSES, OF MAMMALIAN SKIN X-IRRADIATED WHILE ANOXIC AND AT DIFFERENT TEMPERATURES. John P. O'Brien and Edward J. Frank (Marquette Univ., Milwaukee). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 693-702(1959) Oct.

A striking increase in permeability characteristics in rabbit skin, as reflected in localized accumulation of intracardially injected trypan blue, occurs immediately following irradiation of skin (ear) areas under conditions of simultaneously effected anoxia and greatly reduced temperature; no such permeability changes occur in skin areas similarly irradiated while anoxic but maintained at heightened temperature during exposure. These permeability changes occur only when temperature-reduction and irradiation are effected simultaneously. These changes are experimentally reversible and it seems reasonable to regard this as an example of recovery (restoration) from radiation-induced injury. The immediate increase in permeability characteristics,

manifested in the cold-irradiated areas under the conditions of these experiments, is not a reliable criterion of over-all radiation damage, since such areas ultimately exhibit considerably less injury than comparable areas similarly irradiated while warm. These results can be regarded only as highly unexpected and we are not able, at this time, to provide an explanation for the phenomena. These observations emphasize the importance of devising methods to detect changes occurring during the so-called latent period. (auth)

20805

A NOMOGRAM FOR DOSAGE CALCULATIONS IN TELECOBALT THERAPY. Hassan Fateh (Montefiore Hospital, New York). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 706-7(1959) Oct.

A nomogram is described which gives data on depth dose as % air dose at various depths (in cm) and outputs (r/min in air) and treatment times (min). (T.R.H.)

20806

FURTHER INVESTIGATION OF THE EFFECT OF ROENTGEN IRRADIATION UPON THE DEVELOPMENT OF THE HEAD OF THE YOUNG AXOLOTL. V. V. Brunst (Roswell Park Memorial Inst., Buffalo). Am. J. Roentgenol., Radium Therapy Nuclear Med. 82, 708-19(1959) Oct.

The anterior portion or complete head of 120 animals 25 to 32 days after hatching was irradiated mostly with 3,000 r (in one group of 15 with 6,000 r). Definite suppression of growth of the irradiated portion of the head was observed 80 to 110 days after treatment. Especially great was the suppression of the rostral end of the head and lower jaw. The study of reconstructions from sagittal and frontal sections showed the following: the teeth disappeared completely; the growth of olfactory chambers was suppressed greatly, but the olfactory chambers never disappeared completely; the growth of the lower jaw was suppressed and its anterior portion had disappeared; as a result of the reduction of the anterior portion of the lower jaw, the visceral arches shifted in rostral direction; the development of the eyes was suppressed. The tissues and organs of the head of the axolotl are placed in order of decreasing radiosensitivity into the following five groups: (1) The teeth and lymph nodes, which were the most radiosensitive; (2) the olfactory epithelium and the lens; (3) the epithelium of the cornea, the rods and cones layer of the retina, and the gills; (4) other layers of the retina; and (5) the pigment cells of choroid and other tissues of the head, which were comparatively resistant and did not show any clear signs of damage. Specialized but not completely differentiated tissues can be destroyed by roentgen irradiation, after which they are never restored, being replaced by typical skin epithelium with Leydig's cells. This was observed in oral epithelium that forms enamel organs of the teeth, olfactory epithelium of the nasal chambers, and epithelium of the cornea. (auth)

20807

AN OXYGEN EFFECT ON X-IRRADIATED INTRACELLULAR BACTERIOPHAGE T2Hr. James G. Van Dyke (Sloan Kettering Inst. for Cancer Research, New York). Biochem. Biophys. Research Commun. 1, 54-8(1959) Aug.

The existence of an oxygen effect on the x-ray inactivation of intracellular bacteriophage T2Hr was found. Some of the possible implications of these results are discussed. (auth)

20808

INTERMOLECULAR AND INTRAMOLECULAR REACTIONS OF HUMAN-SERUM ALBUMIN AFTER ITS X-IRRADIATION IN AQUEOUS SOLUTION. D. Rosen (Royal Cancer Hospital, London). Biochem. J. 72, 597-602(1959) Aug.

The effect of 140 kv x radiation on aqueous solutions of human-serum albumin has been studied by ultraviolet-absorption spectroscopy, supplemented by light-scattering measurements and ultracentrifuge examination. It is shown that, depending on the conditions of pH and ionic strength, the radiation can produce either or both of two effects: a partly reversible intermolecular effect of aggregation, and an irreversible intramolecular effect which can be detected spectroscopically. The intermolecular aggregation causes light-scattering, which affects the absorption coefficient in spectroscopic measurements. A method of correcting for this is used which, in isoelectric solutions where the radiation effect is almost entirely intermolecular, yields a value of the average molecular weight in quantitative agreement with direct light-scattering measurement. A two-stage process is proposed for the changes occurring in proteins in these conditions. (auth)

20809

CHANGES IN THE PHYSICOCHEMICAL PROPERTIES OF ERYTHROCYTES DUE TO GAMMA-RAY EFFECTS. Yu. A. Kriger and Ye. S. Yelkhovskaya (Lenin Univ., imeni M. V. Lomonosov, Moscow). Biofizika 3, 711-16 (1958).

Human erythrocytes subjected to gamma rays (a dose of 42 kr, 700 rpm/min), then incubated, exhibit an increase of low-frequency electrical resistance, which is substantiated by the swelling of the erythrocyte stroma without rupture. Human erythrocytes subjected to a dose of 84 kr exhibit insignificant amounts of electroconductivity which is connected with definite disturbances in submicroscopic structure of the erythrocyte. Irradiation of erythrocytes without subsequent incubation causes increased ion migration into the electron-free medium, as compared with ion migration of control erythrocytes. Suspensions of irradiated erythrocytes in distilled water exhibit a gradual decrease of their low frequency resistance, which is a phenomenon similar to siroma porosis. (auth)

20810

THE EFFECT OF CERTAIN NUCLEOTIDES AND NUCLEOSIDES ON THE REGENERATION OF HEMOPOIETIC TISSUE AFTER IRRADIATION. Z. Kar-fel', Yu. Soshka, and V. Drashil (Czechoslovak Academy of Sciences, Prague). Biofizika 4, 64-70(1959).

Since it has been demonstrated by many researchers that the synthesis of desoxyribonucleic acid is significantly decreased after irradiation, an attempt to modify desoxyribonucleic acid (DNA) synthesis and through this modification cause the regeneration of hematopoietic tissue by the use of certain nucleotides and nucleosides that are part of the DNA molecule, is reported. The effect of desoxyribonucleotides and desoxyribonucleosides was evaluated according to the blood picture, and the effect of desoxycytidylic acid and cytidylic acid was studied with regard to the synthesis of DNA in vitro bone marrow suspensions, and in vivo tests on mice. Results verify that of the substances used, desoxyribonucleotides which contain the pyrimidine base exert the most favorable postirradiation effect both

on the blood picture and on animal survival. In this research, desoxycytidylic acid, and its mixture with thymidylic acid, when used in small dose, exerted the best effect, and the use of thymidylic acid alone in large quantities also had a favorable effect. Desoxyribonucleosides had an unfavorable effect. Ribonucleotides were ineffective. (auth)

20811

THE EFFECT OF IONIZING RADIATION ON SORPTION PROPERTIES OF FREE CELLS. Ye. A. Ivanitskaya (Academy of Sciences, Moscow). Biofizika 4, 71-7 (1959) Jan.

The sorption of colloids by unirradiated cells at 37°C occurs within 5 to 10 min., after which a state of equilibrium is reached. After irradiation, this sorption capacity of the cells decreases and attains a maximum decrease (40%) 24 hr after irradiation of cells by 1,000r. The sorption of radioactive colloidal Ag^{110} decreases sharply when experiments are conducted at 0°C. In addition to changes in sorption properties after irradiation, a decrease was noted in the electrokinetic motion of erythrocytes. Changes in sorption properties of erythrocytes and in Ehrlich's ascitic carcinoma cell indicate that changes occur in the surface properties of these cells, and these changes, apparently, are closely linked with the rate of metabolism. (auth)

20812

ON THE DECREASED RESISTANCE OF IRRADIATED ERYTHROCYTES IN AN ALKALINE MEDIUM AND THE RELATIONSHIP OF THE LATENT PERIOD OF ALKALINE HEMOLYSIS TO RADIATION DOSE. K. S. Trincher (Inst. of Biological Physics, Academy of Sciences, Moscow). Biofizika 4, 78-83(1959) Jan.

The resistance of irradiated erythrocytes to the subsequent effect of an alkaline medium is sharply decreased as compared with the resistance of unirradiated erythrocytes. This is apparently linked to the radiation injury of the lipid components of lipoproteins in the surface layer of the cells. The resistance of irradiated erythrocytes to acidic medium is approximately equal to that of unirradiated erythrocytes. The correlation of the latent period in the process of alkaline hemolysis to the dose of radiation can be expressed as a simple decreasing exponential function. It is theorized that the surface layer of erythrocytes contains a large number of independent radiosensitive areas, the damage of which substantiates the 'Target Theory.' (auth)

20813

BIOCHEMICAL CHANGES DUE TO THE EFFECT OF LARGE DOSES OF IONIZING RADIATION. R. Ye. Libinzon. Biofizika 4, 89-100(1959) Jan.

The decrease in deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) due to large doses of ionizing radiation is detected sooner, and the fall is greater in bone marrow than in the rest of the tissues studied. The average decrease in the DNA level in the various tissues of the animals dying in the ionizing radiation field was 38%, while that in bone marrow was 50%. The greatest nucleic acid decrease was in bone marrow, then in spleen, and then liver. Changes in nucleic acids found in brain tissue and in eggs were not significant. The extent of DNA and RNA decrease in tissues was linked to the duration of animal survival. Irradiation of animals in powerful fields of ionizing radiation induced essential changes in the composition of DNA. These changes were substantiated by decreased DNA nitrogen content. Total irradiation of dogs by very large doses of ionizing radiation produced a manifold increase in the nonprotein nitrogen of blood serum. A rise in the serum protein level was observed in all animals subjected to radiation doses of 15-240 kr. Adenosinetriphosphate activity in the bone marrow decreased 50% 5 hours after irradiation with 50 kr, but no changes were detected in spleen, liver, or brain enzyme activity. (auth)

20814

CHANGES IN ELASTIC AND VISCOUS SKIN PROPERTIES AFTER LOCAL IRRADIATION BY LARGE X-RAY DOSES. V. M. Mastryukova and A. I. Polivoda. Biofizika 4, 101-7(1959) Jan.

The aim of this research was to study the effect of irradiation and to measure the value of the decrement of damping of the skin and subcutaneous tissues during edema due to irradiation. A special apparatus to measure the value of the decrement of damping (v) was constructed and is sketched and described. Damping curves represent fluctuations of beams produced after hitting the skin in shank area of rabbits with a mallet, and graphs illustrate changes in skin (v). Among the merits of this method is that the values it measures for the elastic and viscous properties of the skin can be detected earlier than the values obtained by other methods known at present. These experiments verify that changes in the elastic and viscous properties of the skin after local irradiation are characterized by the development of edema. Evidently, the value of (v) is closely linked to the physicochemical molecular properties of the live skin.

20815

CHANGES IN LIPID METABOLISM OF PLANTS UNDER THE EFFECT OF IONIZING RADIATION. Ye. V. Budnitskaya, L. G. Borisova, and A. G. Pasynskii (Academy of Sciences, Moscow). Biokhimiya 23, 849-55(1958) Nov.-Dec.

A higher sensitivity to the effect of ionizing radiation has been determined in lipoxidase activity in in vivo leaves of plants, and changes in lipoxidase activity were induced by significantly lower doses (30-50%) in in vivo than in in vitro tests. A phase of enzyme system activation by comparatively lower doses of irradiation and shorter incubation period after irradiation was also noted. It was established that changes in the relative permeability of leaves of plant sprouts due to the effect of ionizing radiations, which confirm the presence of disturbances in the internal cellular structure, facilitate the leakage of electrolytes into the external medium. A change in the over-all permeability, or a change in the internal structure, probably leads to the changes observed in the activity of lipoxidase after the irradiation of plant sprouts. A significant increase was noted in the quantity of peroxides of unsaturated fatty acids after the exposure of sprout leaves of beans and barley to low doses of irradiation (1,000r) which was probably due to enzymatic effect. One may postulate that the significant physiological effect and the toxic property of peroxides of unsaturated fatty acids play a great role in the intoxication of plants under radiation effects. (auth)

20816

SOME IMPLICATIONS OF INDIRECT INDUCTION MECHANISMS IN CARCINOGENESIS: A REVIEW.

Henry S. Kaplan (Stanford Univ., Calif.). Cancer Research 19, 791–803(1959) Sept.

An analytical review is presented on carcinogens, including radiation. 174 references. (T.R.H.)

20817

FAILURE OF RADIOIODINE TO INDUCE THYROID CANCER IN THE RAT. John B. Field, Charles J. McCammon, Rodney J. Valentine, Sol Bernick, Charles Orr, and Paul Starr (Univ. of Southern California, Los Angeles and Los Angeles County General Hospital, Los Angeles). Cancer Research 19, 870–3(1959) Sept.

Of a group of 751 young Long-Evans female rats, 392 were given 275 μc I^{131}, and 48 were given 75 μc I^{131} and subjected to a three-quarter thyroidectomy. All were maintained for a lengthy period of up to 24 to 33 months on a low-iodine goitrogenic regimen. The rats were divided into groups and given dietary supplements or parenteral therapy for the duration of the study. Comparable rats not treated with I^{131} were matched as controls, and another group of rats was maintained for an equal period of time on an iodine-adequate diet. The thyroid gland of most of the 330 autopsied rats treated with I^{131} was partially to almost completely destroyed by the effects of irradiation. Only one rat exhibited a malignancy, and this appeared to be a lymphoma. Nodular or hyperplastic change of the thyroid was rarely encountered. By contrast, 33% of rats given methylthiouracil developed carcinomas of the thyroid gland, and an additional 63% showed marked nodular changes in the gland. The administration of thyroxin reduced the incidence of thyroid cancer in rats treated with methylthiouracil from 33 to 4%. It was not possible to confirm the reports of others that the administration of radioiodine to young adult rats produces a significant incidence of malignant change of the thyroid gland. (auth)

20818

THE EFFECT OF LOCAL FRACTIONATED EXPOSURE TO X-RAYS ON THE COURSE OF REGENERATION PROCESS IN STRIATED MUSCULAR TISSUE. N. V. Kozlova (Central Scientific Research Inst. of Medical Radiology). Doklady Akad. Nauk S.S.S.R. 127, 1121–4 (1959) Aug. 11. (In Russian)

Experiments were carried out with 80 white male mice of identical age and weight exposed to local fractionated x-ray doses (total dose 3000r). The left back leg of one group of animals was exposed to 300r three times a day for a month while the other group was exposed to 100r under the same conditions. The first day after accumulation of 3000r the legs of both groups were impaired. Various stages of regenerative processes in striated muscular tissue were studied. The results show that local fractionated irradiation depressed the post-traumatic regenerative ability of the striated muscular tissue. It was also found that irradiation induced depressions of regenerative processes are caused by radiation damage to muscle tissue. (R.V.J.)

20819

THE EFFECT OF VITAMIN B-COMPLEX ON THE RESISTANCE OF AN ORGANISM TO RADIATION EFFECTS. A. N. Liberman (Central Scientific Research Lab., Kharkov Naval Academy, Kiev). Fiziol. Zhur. S.S.S.R. 4, 814–20(1958) Nov.-Dec.

A series of tests conducted on cats and mice in an attempt to study the prophylactic and therapeutic effects of vitamin B-complex on radiation sickness demonstrated the following: The therapeutic use of vitamin B-complex (B_1, B_2, B_6, B_{12}, PP, folic acid, and P-aminobenzoic acid) has a favorable effect on the course of radiation sickness, increases the survival rate, decreases loss of body weight, and aids in the oxidation-reduction processes in the cellular respiration of a number of vitally important organs. On the contrary, the combined use of a preliminary injection of vitamin B-complex and its therapeutic use during radiation sickness causes a more severe course of radiation sickness, decreases the survival rate, increases loss of body weight, and impairs the oxidation-reduction processes in a number of vitally important organs. The combined preliminary and therapeutic use of vitamin B_{12} alone produces positive shifts in oxidation-reduction processes in a number of organs, but these shifts are less pronounced than those resulting from the therapeutic use of vitamin B-complex. (auth)

20820

AIR IONIZATION IN ROOMS IN WHICH PHYSICAL METHODS OF THERAPY AND DIAGNOSIS ARE USED. M. I. Salmanova (Kuybyshev Medical and Moscow Stomatological Institutes, Moscow). Gigiena i Sanit., 23, No. 11, 74–6(1958) Nov.

Air ionization was determined in various rooms by using a P. N. Tverskiy I-2 counter for light ions with a mobility of 0.5–1.0 and heavy ions with a mobility of 0.001 to 0.002 cm^2/sec per volt. Results indicate that the ionization of air in physiotherapeutic chambers (due to the use of high- and low-frequency currents and light therapy) does not attain a high enough degree of concentration to be of occupational-hygienic significance. In x-ray cabinets when the apparatus is turned on, the concentration of air ions becomes very high, especially when using deep radiotherapy. There is no increase in air ionization when the apparatus is turned off. A high degree of ionization is detected in radiobiological departments and depends on the quantity of radioactive substances found in the room, the storage conditions, and the protective measures taken. The highest concentration of air ions, with the predominance of positive ions, occurs in treatment rooms during the process of "changing" the patients with radium, or during the sterilization of radioactive preparations.

20821

VALUE OF BONE MARROW AND SPLEEN CELL SUSPENSIONS FOR SURVIVAL OF LETHALLY IRRADIATED DOGS. Robert D. Sullivan, Gisela Stecher, and Stephen S. Sternberg (Sloan-Kettering Inst., New York and New York Veterans Administration Hospital). J. Natl. Cancer Inst. 23, 367–83(1959) Sept.

The protective effect of homologous spleen and homologous marrow and of autologous spleen and autologous marrow was studied in 85 mongrel dogs after their single exposure to lethal doses of total-body x radiation. In the autologous experiments the material was administered intravenously and intra-arterially immediately after irradiation, while in the homologous experiments the cell suspensions were given as late as 24 hr after irradiation. No protection was noted with these techniques at radiation dose levels of 600, 550, and 450 r. Survival was somewhat longer at 450 r than at 600 r for both treated and control groups. Within the treated groups, however, there was no appreciable difference in survival at these radiation dosage levels. The delayed administration of homologous marrow up to 24 hours after irradiation and the use of antibiotics and cortisone were likewise without significant protection.

In most animals of all groups, there was depression of the white blood cell count to less than 1,000 cells per mm by the 6th to 9th day, and at post-mortem examination, marrow and lymphoid aplasia were found. Significant protection was noted when autologous marrow was used at radiation dose levels of 400 r. White cell count depression was less severe for the treated than for the control group. Surviving dogs were killed and were found to have normal hematopoietic and lymphatic systems. It is concluded that viable homologous or autologous spleen and marrow cell suspensions failed to protect the mongrel dog against supralethal doses of total-body radiation, but autologous marrow afforded some benefit at marginally lethal dosage levels. (auth)

20822

ELECTROPHORESIS OF PROTEINS OF IRRADIATED MOUSE CHIMERAS. Raymond A. Popp and L. H. Smith (Oak Ridge National Lab., Tenn.). J. Natl. Cancer Inst. 23, 395-409(1959) Sept.

A comparative study was made of the proteins in various tissues of Sprague-Dawley rats and (101 × C3H)F_1 mice. The results were used as a basis for studying changes in the protein patterns in tissues of rat-mouse chimeras: i.e., (101 × C3H)F_1 mice were given 950 r of x rays and then received an injection of bone marrow from Sprague-Dawley rats. Electrophoretic mobilities of rat proteins extracted from the bone marrow, spleen, lymph node, and thymus of chimeras and rats were similar. The quantity of rat proteins and the rate and time at which they appeared in different hematopoietic organs were quite different. Some mouse-type proteins not found in chimera tissues examined 30 days after treatment were frequently present on the 50th day or later, which suggests regression of the graft. The results are consistent with the idea that rat-type proteins synthesized in the cytoplasm of transplanted rat cells are controlled by the genotype of these cells, even in a mouse environment. They also indicate that there are organ-specific differences, in the rate and degree of replacement of transplanted cells, that require further investigation. (auth)

20823

THE ACCUMULATION OF Y^{90} FROM AN EQUILIBRIUM MIXTURE OF Sr^{90}-Y^{90} BY ARTEMIA SALINA (L.). Howard Boroughs, Sidney J. Townsley, and Winifred Ego (Univ. of Hawaii, Honolulu). Limnology and Oceanog. 3, 413-17(1958) Oct.

Artemia salina (L.) was chosen as a representative organism in the second trophic level for studying one phase of the process of transfer of radionuclides through a marine food chain. Adult Artemia were cultured in filtered sea water which contained Sr^{90}-Y^{90}. They were not fed during the experiment which lasted 92 hours. They were removed at intervals, washed, and their radioactivity determined with an end-window counter. At 16 hours the concentration of radioactivity in the Artemia was about 40 times that of an equal weight of sea water. The radioactivity decayed at a rate which was similar to the decay rate of Y^{90}. It was estimated that only about 5 per cent of the activity remaining at secular equilibrium was due to Sr^{90}, the remainder being Y^{90}. This biological fractionation of Sr^{90}-Y^{90} may affect the transfer of these hazardous nuclides through food chains leading to human food. The fractionation of these nuclides by laboratory glassware is briefly discussed. (auth)

20824

THE INFLUENCE OF PENETRATING RADIATION ON THE STATE OF THE HIGHER NERVOUS ACTIVITY IN ANIMALS. V. P. Baskakov (Kirov Military Medical "Order of Lenin" Academy). Med. Radiol. 4, No. 8, 10-13(1959) Aug. (In Russian)

The aim of the experiments, staged on white rats, was to divulge the difference in the changes of conditioned reflex activity of gravid, suckling, and nongravid animals under the influence of penetrating radiation. After the fixation of conditioned reflexes in rats they were given a single whole-body irradiation in a dose of 250 r. An extinction of conditioned reflexes and a change of conduct toward conditioned and unconditioned stimuli could be revealed. These changes appeared in gravid and suckling rats on the first, second, third, and fifth day after the irradiation, in nongravid animals—on the 12th, 13th, and 14th day. Other differences were also observed. (auth)

20825

THE INFLUENCE OF LOW DOSES OF CHRONIC TOTAL X-RAY IRRADIATION ON THE HIGHER NERVOUS ACTIVITY AND CERTAIN VEGETATIVE FUNCTIONS OF WHITE RATS. L. G. Samoĭlova. Med. Radiol. 4, No. 8, 13-17(1959) Aug. (In Russian)

On 16 white male rats the dynamics of changes of the higher nervous activity under the influence of whole-body chronic roentgen irradiation were studied. The single dose amounted to 0.1r. The irradiation was carried out every other day, the total dose for 4½ months being 5 r. First of all the animals displayed signs of weakening of internal inhibition, then there developed supraliminal inhibition manifested by phasic phenomena, consecutive inhibition, and exhaustion of cortical cells. After the irradiation was discontinued, a relative normalization of cortical dynamics occurred. The irradiation did not exert a noticeable influence on the weight and temperature of the body, or on the content of erythrocytes and leukocytes in the peripheral blood. Some differences in the degree and duration of higher nervous activity disturbances in the irradiated animals partly depended upon their typological features. (auth)

20826

THE RECEPTIVE CAPACITY OF IRRADIATED AREAS OF THE BODY IN EXPERIMENTS ON ANIMALS. N. S. Delitsyna. Med. Radiol. 4, No. 8, 17-20(1959) Aug. (In Russian)

The investigations were conducted on rabbits by subjecting one of the extremities to the action of x rays (500 to 5,000 r). Immediately after the irradiation changes in the reaction of the great hemispheres of the brain (the method of electroencephalography) to tactile irritation of the irradiated region were observed. This testifies to the presence of changes in the peripheral receptors of regions of the organism directly subjected to the action of the radiation factor. The change of motor chronaxia of the irradiated as well as the nonirradiated contralateral extremity (experiments on rabbits) is also illustrative of changes of subordination (central) influences on the periphery. Local irradiation of a rabbit's extremity (5,000 r) provoked the development of an ulcerous affection not only on the irradiated extremity, but on the symmetrical area of the nonirradiated contralateral extremity as well. The development of the affection according to a segmentary type apparently testifies to the fact that a nervous mechanism lies at the basis of the process. In 2 cases out of 10 there

was observed a consecutive development of ulcers on all 4 extremities (only one of them was irradiated). (auth)

20827

CHANGES OF THE VENOUS PRESSURE IN RABBITS AFFECTED WITH ACUTE RADIATION SICKNESS. A. S. Mozzhukhin (Kirov Military Medical "Order of Lenin" Academy). Med. Radiol. 4, No. 8, 21-3(1959) Aug. (In Russian)

The changes of venous pressure of rabbits in the systems of the portal vein and inferior and superior venae cava following total x irradiation (800 r) were studied. A statistically confirmed drop of the venous pressure in all the venous systems studied at the period of primary reaction and at the peak of acute radiation sickness was observed. A concurrence of the venous pressure drop with a sharp distension of venous walls of internal organs due to overfilling with blood testifies to a considerable decrease of the tone of the venous walls, predominantly of the internal organs, in acute radiation sickness. (auth)

20828

THE COURSE OF THE EXUDATIVE PHASE OF INFLAMMATION IN IRRADIATED ANIMALS. E. R. Bagramyan (All-Union Inst. of Experimental Endocrinology). Med. Radiol. 4, No. 8, 23-8(1959) Aug. (In Russian)

An exudative inflammation was induced in female rats by the Selye method. The protein composition of the blood serum and the inflammatory exudate was studied electrophoretically. In the irradiated rats (400 r) a change in the character of the inflammatory exudate and inhibition of the exudative phase of inflammation were noticed. The blood serum disclosed a diminution of the albumin content, and an increase of α_1, α_2, and β globulins. During the course of inflammation the blood serum of irradiated and nonirradiated rats showed almost analogous changes: a drop of albumin fraction and a rise of α_1-, α_2-, and β-globulin fractions with the intensification of the severity of radiation sickness. The γ-globulin fraction showed a tendency to decrease in the blood serum of irradiated rats with inflammation. All protein fractions of the serum in normal and irradiated rats passed into the inflammatory exudate. The percentage content of albumins and β globulins in the exudate of nonirradiated rats was higher than in the serum, while that of α_1, α_2, and γ globulins was lower. Changes in the percentage content of albumins and γ globulins in the exudate of irradiated rats, as compared with their serum, depended upon the severity of radiation sickness. ACTH inhibited the development of exudative inflammation and increased the death rate of irradiated animals. (auth)

20829

THE STUDY OF THE ELECTRIC PROPERTIES OF BLOOD BY THE HYDRATION METHOD IN RADIATION AFFECTION. Yu. Yu. Voronoĭ, A. T. Stovbun, A. F. Kosenko (Ukraine Scientific Research Inst. of Nutrition and Ukraine Scientific Research Blood Transfusion Inst.). Med. Radiol. 4, No. 8, 28-32(1959) Aug. (In Russian)

The character of changes of the dielectric properties of blood in dogs subjected to x irradiation with doses ranging from 50 to 1,000 r was studied. The experiments conducted demonstrate that irradiation of the animals with x rays provokes changes of the dielectric properties of blood manifested by an increase of dielectric permeability. The nature of the latter depends upon the dose of irradiation and on the development of the pathological process. The change of the dielectric permeability of the blood is noted in the first hour following irradiation with a dose of 500 to 1,000 r. In irradiation with a dose of 50 r the dielectric permeability changes of the blood are marked to a considerably lesser degree and appear only in one week after the irradiation. (auth)

20830

CHAIN REACTIONS IN THE LIPIDS OF THE LIVER IN RADIATION AFFECTION. A. I. Zhuravlev and E. E. Ganassi. Med. Radiol. 4, No. 8, 32-7(1959) Aug. (In Russian)

It was demonstrated that the irradiated preparations of lipids as well as lipids of the irradiated organisms have an elevated capacity for the formation of peroxide compounds. At the same time the antioxidative capacity in the liver lipids of irradiated organisms drops. The formation of primary peroxides in the irradiated lipids leads to the development of a chain oxidation reaction, which destroys the natural antioxidants and, as a result of this, a noticeable accumulation of peroxides in the samples of fats under study. It is also shown that the degree of accumulation of free fatty acids in the fat as a result of oxidative and autolytic processes is correlated with the hemolytic activity of the fat itself. (auth)

20831

PRIMARY TOXICITY IN ACUTE RADIATION SICKNESS. E. D. Buglov, S. I. Dovgalev, and V. G. Karavaev (Minsk Medical Inst.). Med. Radiol. 4, No. 8, 37-41(1959) Aug. (In Russian)

Data presented show that in the first hours following irradiation there appear in the blood and organs toxic substances, which play a definite role in the pathogenesis of radiation sickness. Transfusion of blood of irradiated animals provokes in the recipient shifts in the morphological and biochemical composition of the blood, which are similar to those occurring after the action of low doses of irradiation. Upon the introduction of spleen and liver extracts of irradiated animals, the toxic effect is manifested without the diminution of the leukocyte count. No hypotensive substances were revealed. The blood composition changes depend mainly upon the action on the hematopoietic organs, in view of the fact that the changes observed are stable and develop in definite periods. The toxicity effect is manifested more regularly in irradiation of the animals with high doses. (auth)

20832

A STUDY OF THE PROBLEM ON THE INFLUENCE OF IONIZING RADIATION UPON THE ANTIGENIC PROPERTIES OF PROTEINS. V. A. Artamonova (Gamaley Inst. of Epidemiology and Microbiology). Med. Radiol. 4, No. 8, 42-9(1959) Aug. (In Russian)

The antigenic structure of nucleic nucleoproteids, cytoplasmatic granules, and hyaloplasm from the liver of irradiated rabbits was compared with that of corresponding fractions of healthy animals in the anaphylaxis reaction with desensitization. The investigation demonstrated that the antigenic component is present in all fractions of the irradiated liver. In the fractions of nucleic nucleoproteids and cytoplasmatic granules of irradiated tissues one of the components of normal tissue, which was contained in the hyaloplasm of irradiated animals, could not be revealed. Immunization of rats with proteins, changed by irradiation, did not rise their resistance to irradiation. (auth)

20833

DIPHTHERIA TOXIN OBTAINED ON MEDIA STERI-

LIZED BY GAMMA RAYS. D. R. Kaulen (Samaley Inst. of Epidemiology and Microbiology). Med. Radiol. 4, No. 8, 49-54(1959) Aug. (In Russian)

The possiblity of radiation sterilization of liquid nutritive media for cultivating diphtheritic bacteria was studied. Gamma rays were employed at doses of 600,000, 1,000,000, and 1,500,000 r. The sterilization of the media by irradiation does not deteriorate their nutritive properties, while the biochemical indices remain almost unchanged. The diphtheria toxin titer obtained on media sterilized by irradiation is not inferior to that derived from autoclaved media, while in a number of instances (irradiation with 600,000 r) it even surpasses it. Anatoxins made of toxins from irradiated media were not inferior by their immunogenic and antigenic properties to the control preparations. These experimental data point to the possibility of "cold" sterilization of liquid nutritive media. (auth)

20834

PECULIARITIES OF DISTRIBUTION AND EXCRETION OF POLONIUM IN ANIMALS SUBJECTED TO UNITHIOL ADMINISTRATION. E. V. Erleksova. Med. Radiol. 4, No. 8, 54-60(1959) Aug. (In Russian)

The action of unithiol on the process of distribution and excretion of polonium from the organism and the character of changes in the organs of white rats in the employment of this preparation were studied. On the basis of autoradiographic and histological investigations it was established that early administration of unithiol accelerates and increases quantitatively the excretion of polonium from the organism. Polonium is discharged mainly through the kidneys, where it concentrates in large quantities. The development of changes in the organs, especially those of the hematopoietic system, is delayed and does not have such a severe form (aplastic anemia) as observed in the control rats. The life span of experimental rats increases from 13 to 95 days. Acute radiation sickness runs a chronic course. As a result of the presence of constant large quantities of an α emitter, dystrophic changes in the kidneys develop at an early date and are of a severe nature. Toward the 102nd to 115th day a picture of nephrosis is observed. (auth)

20835

THE CHANGE OF BLOOD GASES IN DOGS AFFECTED WITH POLONIUM. G. I. Bezin. Med. Radiol. 4, No. 8, 60-6(1959) Aug. (In Russian)

In conditions of an acute and subacute course of radiation sickness in dogs caused by Po^{210} the gases of the blood taken from the femoral vessels were studied. The velocity of circulation was assessed with the aid of the lobeline test. In the acute form from the second week the velocity of circulation slowed down. Manifestations of circulatory hypoxia, and in a number of cases, hypoxemic hypoxia were observed. In the subacute form the manifestations of circulatory hypoxia developed at the end of the first month; histotoxic hypoxia was noted less often. In the first 2 weeks all dogs developed arterial hypocapnia; at the beginning of the first week the oxygen capacity index and the content of O_2 in the arterial blood increased. At the peak of the disease the content of O_2 in renal venous blood was sharply elevated. (auth)

20836

THE REACTIVITY OF BLOOD VESSELS IN AFFECTION OF THE ORGANISM WITH POLONIUM. V. V. Vasil'evskaya. Med. Radiol. 4, No. 8, 66-71(1959) Aug. (In Russian)

In experiments on rats the reactivity of peripheral vessels in poisoning of the organism with polonium was studied. The reaction of central vessels of the ear was assessed thermometrically, the reaction of capillaries and small vessels were assessed visually. The following irritants (mainly vasodilating) were employed: local application of heat or cold, mechanical irritation, general warming of the body, and intraperitoneal introduction of acetylcholine. It was shown that in polonium-affected rats the reaction of vessels of the ear to the vasodilating action is lower; in a number of cases it is absent or reversed. The changes are more pronounced after the 10th day. At this period the vessels of the ear are in a constricted state. The prevalence of the tone of vasoconstrictors, regulating the lumen of peripheral vessels, disturbs the blood supply of superficial tissues in polonium-affected animals. (auth)

20837

RADIATION INJURIES OF OVARIES. M. N. Pobedinsky. Med. Radiol. 4, No. 8, 72-8(1959) Aug. (In Russian)

Experimental and clinical data on the radiation effects on ovaries are reviewed. Effects of single and divided doses, injuries induced by various types of ionizing radiation, and reactions induced by radioactive substances carried into the organism by internal irradiation therapy of gonads are discussed. (R.V.J.)

20838

THE INFLUENCE OF VARYING DOSES OF IONIZING RADIATION ON THE MORPHOLOGY OF THE ANIMAL'S BRAIN IN TOTAL IRRADIATION. M. M. Aleksandrovskaya (Inst. of High-Nervous Activity, Academy of Sciences, USSR). Med. Radiol. 4, No. 8, 79-81(1959) Aug. (In Russian)

Histopathological changes were studied in the brain of 24 white rats exposed to whole-body irradiation (from Co^{60}) by 650, 1300, 1850, and 2950r. Microscopic analysis of the central nervous system showed toxicohypoxic encephalopathy with dystrophic injuries to the neurocytes and productivity of dystrophic glial reactions. (R.V.J.)

20839

MORPHOLOGICAL CHANGES IN THE PERIPHERAL WHITE BLOOD IN WHOLE-BODY X-RAY IRRADIATION COUPLED WITH INJURY OF THE KIDNEY. O. L. Tiktinskii. Med. Radiol. 4, No. 8, 81-2(1959) Aug. (In Russian)

The morphological picture of peripheral white blood in dogs and rabbits following whole-body exposure to 350 and 500 r, coupled with a kidney injury, is basically identical to that in animals without a kidney injury. The more expressed neutrophil leucocytosis at first stages after exposure, persistent leukopenia until death, and the absence of initial phases of leucocytosis in animals exposed to lethal doses, eozinophylia in animals treated with penicillin, and in some cases of leucocytosis during acute stages of injury, are the positive prognostic factors. (R.V.J.)

20840

DISORGANIZATION OF THE SECONDARY STRUCTURE IN PROTEINS EXPOSED TO IONIZING RADIATIONS IN THE SOLID STATE. Peter Alexander, L. D. G. Hamilton, and K. A. Stacey (Inst. of Cancer Research, London). Nature 184, 226-8(1959) July 25.

A study was made of the changes produced in solid crystalline bovine serum albumin (containing 4 to 6% water) by 2-Mev electrons. In the absence of O_2 a large part of the molecule is disorganized as the result of a

breaking of many secondary valence bonds. This breaking occurs about once for each 45 ev absorbed and can therefore be considered as a primary ionization. The occurrence of this type of process provides a mechanism for inactivation of heat-labile enzymes by ionizing radiation. (T.R.H.)

20841

COMPETITIVE INHIBITION OF SUCCINOXIDASE BY ACETYLENE DICARBOXYLATE. John F. Thomson (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 101, 589-91(1959) Aug.-Sept.

Acetylene dicarboxylate (ADC) is a competitive inhibitor of succinoxidase. The apparent dissociation constant of the ADC-enzyme complex is about $\frac{1}{8}$ that of the succinate-enzyme complex when the inhibitor is added to the enzyme after or along with the substrate. However, when the enzyme, inhibitor, and substrate are incubated 18 hours before assay, the value of K_I is about $\frac{1}{25}$ that of K_S. (auth)

20842

SOLUBILITY OF HEMOGLOBIN AS RED CELL MARKER IN IRRADIATED MOUSE CHIMERAS. Raymond A. Popp and G. E. Cosgrove (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 101, 754-8(1959) Aug.-Sept.

Genetically different mouse hemoglobins differ in solubility and crystal formation. Differences in hemoglobin solubility and crystal formation can therefore be used to identify homologous erythrocytes in irradiated mouse chimeras if the hemoglobin types of donor and recipient mice are distinguishable by these properties to begin with. (auth)

20843

IMPLANTATION OF NORMAL BLOOD-FORMING TISSUE IN GENETICALLY ANEMIC MICE, WITHOUT X-IRRADIATION OF HOST. Seldon E. Bernstein and Elizabeth S. Russell (Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.). Proc. Soc. Exptl. Biol. Med. 101, 769-73(1959) Aug.-Sept.

Successful implantation, without x-irradiation or other pretreatment of host, of isologous blood forming tissue from normal (ww) mouse fetal liver in viable severely anemic recipients (20 of 24 adult WW^v mice, 9 of 14 juvenile WW^v mice) and in lethally anemic recipients (4 of 15 juvenile WW mice) has been demonstrated. Criteria of success were permanent increase in rbc/mm^3 to near-normal levels, and decrease of mean cell volume from macrocytic to normocytic levels. These changes appeared in WW^v adult anemic hosts longer after cell injection than in similar transplant experiments with WW^v hosts subjected to 200-r whole-body irradiation. These findings fit well with the hypothesis of competition between slow-acting indigenous blood forming tissue of genetically anemic hosts and initially small implants of rapidly functioning blood forming tissue from genetically normal donors. If methods for circumventing homografts can be found, cell implantation may be generally useful for therapy of genetic defects in erythropoiesis. (auth)

20844

RADIOLYSIS OF AQUEOUS SOLUTIONS OF BENZENE AND OF PHENOL. K. C. Kurien, P. V. Phung, and Milton Burton (Univ. of Notre Dame, Ind.). Radiation Research 11, 283-90(1959) Sept.

Both benzene and phenol are without effect on the "primary" yields of H, OH, H_2, and H_2O_2 in the radiolysis of water. It is concluded that they have no effect on the immediate (excited or ionized) precursors of those products; i.e., they show no true protective effect (7) in water. In other words, if some persistent excited state of water is involved in formation of reaction products, its half-life is nevertheless so short as to forbid interaction with dissolved benzene or phenol. Benzene reacts much more rapidly with free OH radical than does phenol (through reaction 6), but the rate constant for reaction with free H atom is about half as great as for phenol. (auth)

20845

EFFECT OF ABSORBING MATERIALS ON RADIATION INACTIVATION OF DEOXYRIBONUCLEASE I. George Fletcher and Shigefumi Okada (Univ. of Rochester, N. Y.). Radiation Research 11, 291-8(1959) Sept.

The results show that the presence of chemically unrelated materials with adsorptive capacity affords protection from inactivation by ionizing radiation of deoxyribonuclease I in aqueous solution. It was observed that the degree of radiation inactivation is a function of the distribution of the enzymatic activity between adsorbed and soluble states. Complete protection of DNase I from inactivation by 1090 r of x rays could be achieved when essentially all the enzyme was adsorbed on powdered cellulose, whereas 63% was inactivated when the enzyme was present in aqueous solution without cellulose. The mechanism responsible for protection of the enzyme in the adsorbed state is considered to be due to the concentration gradient at the interface, although changes in the physicochemical state of adsorbed enzyme cannot be excluded. The biological implications of these observations are discussed. (auth)

20846

RADIUM IN HUMAN BONE: THE DOSE IN MICROSCOPIC VOLUMES OF BONE. R. E. Rowland and J. H. Marshall (Argonne National Lab., Lemont, Ill.). Radiation Research 11, 299-313[1959] Sept.

The terminal Ra^{226} distributions found in bone samples from individuals who carried radium 20 years or more have been measured. These distributions have been expressed as terminal dose rates, in units of rads per day. The activity in the diffuse distribution of radium has been found to be relatively uniform in cortical bone. The average magnitude of this activity is about one-half of the hypothetical uniform distribution, i.e., the body burden divided by the bone weight. The specific activities found in the hotspots are, on the average, ninety times as great as that in the diffuse distribution, or thus about forty-five times as great as a hypothetical uniform distribution. From a calculated blood curve, constructed to describe the disappearance of Ra^{226} from the blood of those patients who received equal weekly injections of $RaCl_2$, we can predict the specific activity at which the hotspots were formed. Since the terminal activities are less than one-tenth this value, we assume that a long-term exchange process may have removed nine-tenths of the original activity over a 26-year period. (auth)

20847

THE MORTALITY RESPONSE OF THE BURRO (EQUUS ASINUS) TO A SINGLE TOTAL-BODY EXPOSURE OF GAMMA RADIATIONS FROM Zr^{95}/Nb^{95}. Bernard F. Trum (Harvard Medical School, Boston); John J. Lane (U. S. Atomic Energy Commission, Washington, D. C.); U. S. G. Kuhn (Univ. of Tennessee Agricultural Experiment Station, Oak Ridge); and John H. Rust (Armed

Forces Inst. of Pathology, Washington, D. C.). Radiation Research 11, 314-25(1959) Sept.

The $LD_{50(30}$ for burros irradiated at a rate of 15 r/hr with γ radiation from Zr^{95}/Nb^{95} sources was 585 r with a 95% confidence interval of 530 to 627 r. The mode of death was characterized by an absence of early deaths and occasional prolonged survival time beyond 30 days, of lethally irradiated animals. A variable I^{131} uptake by thyroid, decreased iron uptake, increased blood pyruvic acid and pancytopenia were measured in circulating blood of irradiated animals. The lethality of γ-irradiation from Zr^{95}/Nb^{95} was greater than that of γ-radiations from Co^{60} or Ta^{182} if the free-in-air doses were compared. The midline doses necessary to produce the same biological effects were about equal, however, for the various sources when all factors were considered. (auth)

20848

RADIATION INJURY AND RECOVERY IN SWINE. Bernard F. Trum (Harvard Medical School, Boston); James N. Shively (Walter Reed Army Inst. of Research, Washington, D. C.); U. S. G. Kuhn (Univ. of Tennessee Agricultural Experiment Station, Oak Ridge); and Walter T. Carll. Radiation Research 11, 326-42(1959) Sept.

Swine exposed to an initial dose of ionizing radiation were allowed 90 days of recuperation and then subjected to 50 r of γ-radiation daily until death. The hogs lived from 83 to 385 days. The mean survival times of the group were related to the size of the initial irradiation. Residual or irreparable damage at 90 days postirradiation measured in terms of survival to daily irradiation was not a constant per cent of initial dose. The dose at midcenter of the hog, calculated from measurements made within a hog carcass or a water-filled Lucite phantom, would have varied between 35 and 70% of the measured air dose, depending on the size of the hog and its position in the radiation field. One case of lymphatic leukemia occurred in the experimental animals. Other clinical, hematologic, and pathologic changes were noted. (auth)

20849

THE EFFECT OF THE DISTRIBUTION OF SULFUR ON THE LETHAL ACTION OF INCORPORATED $S^{35}O_4$. Bernard S. Strauss (Syracuse Univ., N. Y.). Radiation Research 11, 345-56(1959) Sept.

Radioactive sulfur incorporated into Neurospora conidia inactivates the conidia with an inactivation constant of 1.0×10^{-5} in the decay relation $2.3 \log N/N_0 = -\alpha D$. This corresponds to a radiation dose of 19,400 rads to inactivate 50% of a sample of conidia. The corresponding x-ray dose required to inactivate 50% of a conidial sample is 23,700 rads. No transmutation effect was demonstrated. (auth)

20850

THE EFFECT OF MULTIPLE EXPOSURES AND PARTIAL-BODY X-IRRADIATION ON URINARY TAURINE EXCRETION BY THE RAT. Robert E. Kay and Cecil Entenman (Naval Radiological Defense Lab., San Francisco). Radiation Research 11, 357-69(1959) Sept.

Evidence has been presented which indicates that there is in the rat a substance or mechanism which under the influence of x-irradiation gives rise to a limited excretion of taurine. After a whole-body irradiation dose that gives a maximal response the radiosensitive material or mechanism is re-established, but only after an interval of at least 7 days. The substance or mechanism is apparently localized in the abdominal area, since the response is obtained only if the abdomen is irradiated. The response is not due to the irradiation of any one organ in the abdomen, however, since shielding of the individual organs in this area does not prevent the excessive excretion of taurine, and irradiation of individual organs does not cause it. The presence of the pancreas is necessary in order to obtain an excessive excretion of taurine after x-irradiation, whereas the presence of the spleen, adrenals, kidneys, and hypophysis is not. (auth)

20851

THE IRRADIATION CHEMISTRY OF DILUTE AQUEOUS SOLUTIONS OF CYCLOHEXANONE. William F. Serat and James F. Mead (Univ. of California, Los Angeles). Radiation Research 11, 370-82(1959) Sept.

In an attempt to elucidate the action of ionizing radiation on substances present in the skin lipids, such as the provitamin D sterols, the irradiation of ergosterol was studied. The complexity of changes induced in this molecule has led to an attempt to study portions of the molecule separately. The first of such portions, cyclohexanol, representing ring A, when irradiated in dilute aqueous solution, gave products which were also produced by irradiation of cyclohexanone, a probable first step in the process. A study of the irradiation chemistry of cyclohexanone was therefore initiated. Products identified in the irradiated aqueous solutions were the 1,2- and 1,3-cyclohexanediones, adipic acid, and possibly ε-hydroxycaproic acid. The first two compounds can be considered as being formed by oxidation of the intact cyclohexanone ring and were determined by their ultraviolet absorption spectra. The latter two are products of ring scission and were identified on paper chromatograms. Rate studies indicated that production of 1,3-cyclohexanedione is a function of dose and oxygen pressure but is independent of dose rate and initial concentration of cyclohexanone. A low pH increased the amount of dione formed, whereas a high pH abolished it. With this knowledge, alternative mechanisms have been considered for the reactions occurring when this and similar compounds are irradiated in dilute aqueous solution. (auth)

20852

A STUDY OF THE CHANGES OCCURRING IN RADIOSENSITIVITY DURING SPORE GERMINATION. Carl Woese (Yale Univ., New Haven). Radiation Research 11, 390-8(1959) Sept.

The changes in sensitivity to ultraviolet irradiation occurring during the germination of spores of Bacillus megaterium are reported. A comparison of nonlysogenic, noninducible lysogenic, and inducible lysogenic strains reveals that until elongation of the germinating spore begins there is very little difference among the three types. At that point the multiplicity of the survival curves of the first two types increases from two per cell to about four to eight per cell in the vegetative cell. The over-all increase in sensitivity is about a factor of 3. For the case of inducible lysogenic strains, however, the survival curve changes from a multiplicity of two per cell at the beginning of elongation to one per cell, where it remains. The sensitivity also increases greatly from this point on, until that of the vegetative cell is about forty times that of the germinating spore before elongation. (auth)

20853

EFFECTS OF GAMMA RADIATION ON CALVES. M. O. Schultze, V. Perman, N. S. Mizuno, F. W. Bates, J. H. Sautter, H. S. Isbin, and M. K. Loken (Univ. of Minnesota, St. Paul and Minneapolis). Radiation Research 11, 399-408(1959) Sept.

Twenty-seven calves were exposed to whole-body γ-radiation from a Co^{60} source with a skin exposure dose rate of about 6.6 r per minute. The tissue exposure doses at the midline ranged from 150 to 360 r. All except one animal receiving a tissue exposure dose at the midline of 250 r or more developed acute hypoplasia of the bone marrow and a hemorrhagic syndrome and died after 14 to 24 days. One calf exposed to 350 r developed an acute intestinal radiation syndrome and died on the fifth day. Two calves exposed to 150 r developed a severe blood dyscrasia between the twentieth and thirtieth day, from which they recovered. They appeared to be normal by 270 days. The time sequence and extent of the changes in the circulating derivatives of the hematopoietic tissues were essentially the same as those described in other mammalian species. (auth)

20854

MUTAGENIC RESPONSE DURING SPORULATION OF BACILLUS CEREUS. W. C. McDonald and Orville Wyss (Univ. of Texas, Austin). Radiation Research 11, 409-17(1959) Sept.

Populations of Bacillus cereus undergoing sporulation in distilled water exhibit a period of constant sensitivity to the lethal and mutagenic effects of radiation during the first half of the process. This is followed by a sensitive period, due to some process or processes occurring during sporogenesis, and not the loss of protective material, such as RNA. Subsequent to this the developing spore becomes refractory to the dose mutagenic for vegetative cells before developing heat resistance. The length of the delay in maximal expression of induced mutants was the same for mutants screened from spores of irradiated vegetative cells and mutants resulting from irradiated vegetative cells not permitted to sporulate. The effects were similar with ultraviolet and x-irradiation. (auth)

20855

MONTE CARLO CALCULATIONS OF ELECTRON ENERGY LOSS. D. O. Schneider and D. V. Cormack (Univ. of Saskatchewan, Saskatoon, Can.). Radiation Research 11, 418-29(1959) Sept.

The slowing down of electrons in water has been investigated by Monte Carlo calculations in which the slowing-down process has been considered to be continuous for individual energy losses less than various cutoff values. Calculations were performed for initial energies of 30 kev, 50 kev, and 1.5 Mev to give the case histories of the primary electrons for energy "cutoff" values of 0.1 kev, 0.3 kev, and 3 kev. The histories were analyzed to give the probability of the electron's existing at various energies below the source energy. From this probability one can calculate the flux of primary electrons at a particular energy. Except for energies very close to the source energy this primary electron flux was found to be independent of the source energy and to be essentially equal to the reciprocal of total stopping power; i.e., under these conditions the continuous-loss model may be used to calculate the primary flux. The peak in the distribution immediately below the source energy was found to contribute less than 1% to the total energy absorption. From the case histories for the 50-kev electrons the corresponding ranges of the primary electrons were found and plotted to show the range straggling. The average of these ranges was found to be in good agreement with that calculated from the total stopping power. (auth)

20856

THE VISUALIZATION OF INTERNAL ORGANS BY ACCENTUATION SCINTILLATION SCANNING TECHNICS. William J. MacIntyre, Hymer L. Friedell, Godofredo Gomez Crespo, and Abbas M. Rejali (Western Reserve Univ., Cleveland). Radiology 73, 329-40 (1959) Sept.

A counting rate cut-off circuit and a light-recording accentuation technic have been utilized for the visualization of small differences in the uptake of radioactive material by the liver and by various blood pools. Examples are shown of the use of these technics to emphasize the invasion of the liver by both benign and neoplastic processes, the separation of pericardial effusion from cardiac enlargement or dilatation, and the differentiation of mediastinal masses from aneurysm of the aorta. The need of multiple levels in this technic is stressed, and the application of an electromagnetic tape recorder for this purpose is described. (auth)

20857

DOSAGE TABLES FOR LINEAR RADIUM SOURCES FILTERED BY 0.5 AND 1.0 mm. OF PLATINUM. M. A. Greenfield, M. Fichman, and A. Norman (Univ. of California, Los Angeles). Radiology 73, 418-19 (1959) Sept.

Tables computed by linear interpolation from Sievert's integrals are presented for 0.5 and 1.0 mm Pt filters. (T.R.H.)

20858

TOTAL-BODY X-IRRADIATION AND SPLENECTOMY IN GUINEA-PIGS. Pietro de Franciscis and Emilio Scanziani (Univ. of Naples and Principi di Piemonte Hospital, Naples). Radiology 73, 424-9(1959) Sept.

A total of 295 normal and splenectomized guinea-pigs were submitted to filtered and unfiltered x-rays generated by a 180 to 200-kv machine, in doses of 650, 1,300, and 1,950 r. The biological effects differed with different qualities of radiation. Splenectomy had a definite protective action against x-ray injuries. This protective effect was greater against the lower dosages. (auth)

20859

THE EFFECT OF X RAYS ON NERVE TISSUE METABOLISM. P. F. Minayev and R. I. Skvortsova (Academy of Sciences, Ukrainian, S.S.R.). Voprosy Biokhim. Nervnoĭ Sistemy Akad. Nauk Ukr. S.S.R. Inst. Biokhim. Trudy 2-1 Nauch. Konf. Kiev, 289-94(1957). (Translated from Referat. Zhur. Khim. Biol. Khim. No. 23, 1958, Abstract No. 30991).

Local irradiation of the cerebellum of guinea pigs by x-ray doses of 16,000 and of 9,000 to 12,000r caused very insignificant changes in the glutamic acid (a decrease of 6 to 12 mg %) and glutamine (a rise of 5 to 14 mg %) content in the brain tissue. The quantity of ammonia remained unchanged in all cases of local irradiation of the cerebellum. After total irradiation by doses that exceed the lethal dose by 2 to 4.5 times, (1,000 and 2,000r), the level of glutamic acid in the brain is decreased by 20 to 38 mg %, and the level of glutamine is also decreased, while there is an insignificant rise in the ammonia. (auth)

20860

THE EFFECT OF GENERAL X-RAYS IRRADIATION ON THE RESTORATION OF SERUM PROTEINS IN DOGS AFTER HEMORRHAGE. V. M. Rodionov, V. D. Uspenskaya, O. G. Zamyatkina, T. A. Grunt, and V. P. Polyakova (Academy of Medical Sciences, U.S.S.R.). Voprosy Med. Khim. 4, 327-38(1958) Sept.-Oct.

The aim of this research was to study the shifts in the normal restoration picture of various fractions of serum proteins after hemorrhage following irradiation. Various tables and diagrams and electrophoretic tracings accompany the article. The authors make the following conclusions: the majority of dogs in which hemorrhage was induced 1-6 days after irradiation (by 500 r) died. In these dogs, essential changes were noted in the processes of serum protein restoration, and there was an increase in the blood stream of a type of protein having the electrophoretic mobility of alpha globulins. In dogs subjected to hemorrhage 1½ months after irradiation, the serum protein restoration picture was similar to that of nonirradiated animals subjected to hemorrhage. Evidently these facts indicate that during the acute phase of radiation sickness the processes of regeneration of serum albumin are inhibited, but the organism does not lose the capacity to mobilize extravascular reserves of this protein and to use alpha-3-globulin sources as the albumin deficiency rises in the vascular bed.

20861

NUCLEIC ACID CONTENT AND SYNTHESIS IN LIVER DURING SUBACUTE POISONING BY PLUTONIUM. V. V. Konstantinova and R. Ye. Libinzon. Voprosy Med. Khim. 4, 339-44(1958) Sept.-Oct.

A plutonium nitrate solution (0.02 microcuries per g of body weight) was injected intraperitoneally into rats to study the effect of plutonium on the content and synthesis of nucleic acids in the rat livers. Appropriate tests were conducted 1 to 2 weeks, and 1 to 2 months later. Injections of radioactive phosphorus were administered 4 hours before sacrificing the animals. Tables and graphs present experimental data. Results indicate the following: one or 2 months after the plutonium injection the amount of RNA was increased by approximately 25% on the average. The DNA content in the liver tissue was decreased (26% below normal on the average) starting with the second week and all through the experimental period. After plutonium poisoning, the permeability of hepatic tissue toward radioactive phosphorus was increased. The rate of RNA, and DNA synthesis was accelerated almost during the entire experimental period.

20862

COMPARATIVE EVALUATION OF CERTAIN METHODS OF TREATMENT OF EXPERIMENTAL SHOCK UNDER CONDITIONS OF RADIATION SICKNESS. Yu. M. Bryakin (Inst. of Clinical and Experimental Surgery, Academy of Sciences, Kazakh S.S.R.,). Zdravookhraneniye Kazakhstana, No. 8, 42-8(1958).

Experiments for studying the course and treatment of peptone shock against a background of radiation sickness were conducted on dogs. Specific items included: the use of Polosukhin's antishock fluid (25 ml of sodium chloride, 1.5 ml of calcium chloride, 0.5 ml of sodium hypophosphate, and distilled water to bring the volume to 500 ml); the use of Asratyan's antishock fluid (16 ml of sodium chloride, 1.5 ml of sodium bromide, 1.2 ml of sodium bicarbonate, and distilled water to bring the volume to 1,000 ml); the use of the neuroplegic mixture (2 mg of aminazine, 2 mg of dimedrol, 0.1 ml of a one-% morphine sulfate solution, 0.1 of a one-% atropine sulfate solution, and physiological salt solution to equal 10 ml per kg body weight); transfusion of fresh whole blood; and the combined use of Polosukhin's antishock fluid plus fresh blood. Control and experimental dogs were irradiated with 500 r total x-ray dose. The data obtained indicate that experimental peptone shock arising during the initial phase of acute radiation sickness is characterized by a high mortality rate. (auth)

20863

ITOGI NAUKI, BIOLOGICHESKIYE NAUKI, NO 1 RADIOBIOLOGIYA, BIOLOGICHESKOYE DEYSTVIYE IONIZIRUYUSHCHIKH IZLUCHENIY. (Scientific Reviews, Biological Sciences, No. 1, Radiobiology, Biological Effects of Ionizing Radiations.) A. M. Kuzin, ed. Moscow, 1957. 436p.

The different chapters dealing with various topics are reviewed by specialists actively engaged in their respective fields of radiobiology. Topics discussed in detail include the following: problems connected with the effect of massive doses of ionizing radiation; biological effects of chronic irradiation with small doses of radiation with regard to sensitivity and immunity; gonadal sensitivity and genetic dangers, and the possibility of the formation of new types of organisms; limits of permissible doses of radiation; the use of radiation in agriculture and entomology; and the dangers of possible migration and concentration of radioactive elements in nature. (auth)

20864

RADIATION HYGIENE HANDBOOK. First Edition. Hanson Blatz, ed. New York, McGraw-Hill Book Company, Inc., 1959. 947p.

A compendium of information is presented which will be useful in industry and research involving peaceful uses of atomic energy. It includes: general reference data, glossary of terms, exposure standards and regulations, natural background, ionizing radiation, sources, effects on matter, attenuation data, lab design, detection and measurement, industrial and research and medical applications, determination of exposures, nuclear safety, radiation hygiene chemistry, equipment for handling, storage, and transportation of radioactive materials, surface contamination and decontamination, physiological effects of radiation, sampling equipment, waste disposal, control of radioactive air pollution, and personnel control. (T.R.H.)

20865

SECHZIG JAHRE MEDIZINISCHE RADIOLOGIE. PROBLEME UND EMPIRIE. (Sixty Years of Medical Radiology. Problems and Empirics.) Hans R. Schinz. Stuttgart, Georg Thieme Verlag, 1959. 275p. DM 19.50.

A brief history is presented of the development and progress of medical radiology and of the men who contributed to its development. The discovery of radiation, the technical discoveries, radiobiological knowledge, x-ray diagnostics, radiotherapy and nuclear medicine, radiation determination, dangers, and protection, and teaching, learning, and research in radiology are discussed. Reprints are given of the original articles by Röntgen, Becquerel, the Curies, Rutherford, and Hahn and Strassmann, in which they announced their discoveries in the field of radiation. (J.S.R.)

20866

TECHNISCHER STRAHLENSCHUTZ. I. STRAHLENABSCHIRMUNG DURCH BETON. II. BESEITIGUNG RADIOAKTIVER ABFALLSTOFFE. (Industrial Radioprotection. I. Radiation Shielding by Concrete. II. Elimination of Radioactive Waste Material.) Thomas Jaeger. Munich, Verlag Karl Thiemig, 1959. 192p. DM 8.60.

As an introduction to the consideration of industrial radioprotection, the radiobiological fundamentals are explained with a discussion of the biological effects of radiation and a tabulation of the highest permissible radiation burdens. In the section on radiation shielding by concrete, the physical foundations of radiation protection, calculation of radiation attenuation, and the application of concrete as a shielding material are considered. In the discussion of elimination of radioactive wastes the methods used in the processing and disposal of wastes, which are formed in large quantities and with a wide range of activity levels in nuclear research and nuclear industry, are surveyed. 364 references. (J.S.R.)

CHEMISTRY

General

20867 3B-M-331

Columbia Univ., New York. Div. of War Research.
C-616 [UF_6] HYDROLYSIS FUMES. M. Fisher and M. R. Cines. Jan. 24, 1945. Decl. Sept. 15, 1959. 6p. Contract W-7405-Eng-50. $1.80(ph), $1.80(mf) OTS.

Experiments were carried out to determine how fast the concentration of suspended material decreases in fumes produced by the hydrolysis of UF_6 vapor in damp air. The rate of aggregation is a function chiefly of the number of particles per unit gas volume, but depends also on the chemical composition, size and shape of the particles, the temperature and pressure, and the degree of agitation. The rate of settling depends on the weight and shape of the particles and the viscosity of the gas. (W.L.H.)

20868 AAEC/E-16

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
STUDIES OF SMALL PARTICLE SUSPENSIONS FOR L.M.F.R. PART II. FLUID FLOW WITH SUSPENSIONS SIMULATING THE UBe_{13}–Na SYSTEM. R. C. Cairns and K. S. Turner. Feb. 1958. 31p.

Suspensions of barium sulfate in water at concentrations of up to 16.5 wt. % were circulated in a 1-inch loop to simulate the behavior of the UB_{13}-Na system for L.M.F.R. In a horizontal pipe the mean velocity for the formation of a moving bed was 1.6 feet per second and the mean velocity for the formation of a stationary bed was 1.4 feet per second. The corresponding mean Reynolds numbers were 15,000 and 13,000, respectively. For fully suspended flow, friction factors were the same as for clean water providing the density and viscosity terms in the Reynolds number related to the suspension. The validity of the Orr and Dallavalle viscosity equation for such systems was confirmed and non-Newtonian relationships were not required. Striations similar to those previously reported for the tungsten–water system, were observed before and during settling. (auth)

20869 AAEC/E-17

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
STUDIES OF SMALL PARTICLE SUSPENSIONS FOR L.M.F.R. PART III. CORRELATION OF HORIZONTAL SETTLING VELOCITIES. R. C. Cairns. Feb. 1958. 13p.

The available experimental data for the horizontal settling velocities of suspensions with particles of small size were collected. These were compared with the velocities calculated from the several equations existing in the literature for predicting horizontal settling velocities. No consistent agreement between the experimental and calculated velocities was found. Using the effective density ratio, defined as the ratio of the difference in density between solid and liquid to the density of the liquid, the experimental values were correlated satisfactorily. Further data are needed before a generalized correlation for suspensions can be established. (auth)

20870 AD-215096

Pennsylvania. Univ., Philadelphia.
THE ELECTRICAL CONDUCTANCE AND STRUCTURE OF SIMPLE MOLTEN ELECTROLYTES. Final Technical Report [for] October 16, 1955–October 15, 1958 on THE PROPERTIES AND CONSTITUTION OF LIQUID ELECTROLYTES. E. H. Crook and J. O'M. Bockris. 352p. Contract DA-36-034-ORD-1765.

The electrical conductance of Group II A and B halides, except those of beryllium, was investigated. A review of previous work and techniques is presented, and methods and apparatus used in the present experiments are described. Results are presented graphically and tabularly. 239 references. (J.R.D.)

20871 AECU-4317

Michigan. Univ., Ann Arbor.
MECHANISMS OF ORGANIC ELECTRODE REACTIONS. Report No. 49. Philip J. Elving and Bernard Pullman. June 1, 1959. 43p. Contract AT(11-1)-70, Project 8. $6.30(ph), $3.00(mf) OTS.

Current approaches to the problem of the elucidation of the mechanisms of organic electrode processes are discussed with emphasis on their fundamental bases and interrelations. These approaches involve consideration of the electrode reaction with emphasis on the possible sequence of chemical reactions, the stages in the electrochemical process, and the energetic factors involved from the thermodynamic, kinetic, and quantum mechanical viewpoints. In view of the predominance of organic reduction processes described in the literature, the discussion stresses electroreduction. A general chemical reaction mechanistic scheme is proposed, which indicates why organic electrode reactions usually appear to be of free radical or substitution types. Examples of two general types of organic bond rupture are used for illustration: sigma bond breaking in single bond systems as in electrochemical carbon-halogen bond fission and pi bond rupture in multiple bond systems as in electrochemical carbonyl group reduction. (auth)

20872 AECU-4329

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
AN ORIFICE PLATE PULSE COLUMN FOR LIQUID-LIQUID EXTRACTION (thesis). D. C. O'Brien. Aug. 23, 1954. 70p. For Carbide and Carbon Chemi-

cals Co. K-25 Plant. Contract W-7405-eng-26, Subcontract 70. (KT-170). $10.80(ph), $3.90(mf) OTS.

A study was made of the performance of an orifice plate pulse column which is essentially a spray column containing internal constrictions in the form of orifices. The chemical system studied was acetic acid-water-hexone, and the variables considered were pulse frequency, throughput, phase continuity, and direction of solute transfer. For comparison purposes, several runs were made with a conventional spray column. Curves are presented showing the effect of the column variables on the column efficiency (HTU). The trends observed are explained as being due principally to the competing effects of the area for mass transfer and back-mixing. Photographs of a typical column section show qualitatively the effect of the important column variables. (auth)

20873 AECU-4345

Utah. Univ., Salt Lake City.

CATALYTIC COMBINATION OF HYDROGEN AND OXYGEN IN THORIA SLURRIES. [PART] I. Technical Report No. IV. Charles H. Pitt, Frederic H. Megerth, David A. Reese, and Milton E. Wadsworth. May 31, 1959. 25p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 1075. $4.80(ph), $2.70(mf) OTS.

The problem of the catalytic combination of hydrogen and oxygen in a thoria slurry was approached by determining the effect of variations in treatment of thoria in the calcining step on combination rates. The equipment used to determine the combination rate is described. It was found that calcining thoria in contact with platinum metal greatly enhanced the combination rate. The rate was found to be linear with thoria concentration. Results are given for the effect on the combination rate for thoria calcination in the temperature range 800 to 1450°C using both platinized and nonplatinized thoria. A series of runs was made to determine the variation of the rate for repeated cycles using the same catalyst. (auth)

20874 AERE-R-3030

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF RADIOSTRONTIUM IN BIOLOGICAL MATERIALS. F. J. Bryant, A Morgan, and G. S. Spicer. Aug. 1959. 38p. $0.77(BIS).

The procedures for the collection and preliminary treatment of biological materials are briefly described. Detailed analytical methods for the separation of radiostrontium from bone, milk, vegetable ashes, and soil are given, with some notes on the treatment of other materials. Procedures for counting and the calculation of strontium-89 and strontium-90 contents are appended. (auth)

20875 AFOSR-TN-58-17

Rensselaer Polytechnic Inst., Troy, N. Y.

PHYSICAL PROPERTIES AND CONSTITUTION OF MOLTEN SALTS — ELECTRICAL CONDUCTANCE, TRANSPORT, AND CRYOSCOPY. Technical Note No. 6. Cyril Solomons and George J. Janz. Dec. 1957. 98p. Project Chem 40-45. Contract AF49(638)-50. (AD-148056).

A review was made of the literature on theories and experimental techniques for electrical conductance, electrical transport, and cryoscopy of molten salt systems. Structural and constitutional aspects are emphasized. 278 references. (auth)

20876 ALI-27(Del.)

Little (Arthur D.) Inc., Cambridge, Mass.

INTERIM MEMORANDUM REPORT ON FILTER DEVELOPMENT AND DISCUSSION ON AVAILABILITY OF MATERIALS. May 19, 1959. 54p. Contract AT-30-3-GEN-14. (ALI-C-57896(Del.)).

A preliminary report on development of filter paper for use in A.E.C. operations is presented. Filters for use in removing harmful dusts or radioactive matter from the air discharged from various operations or for other uses are described. The main fiber furnished for the paper is a specially treated wood pulp with an addition of asbestos. Filters of higher or lower efficiencies with corresponding changes in static resistance can readily be made by modifying the manufacturing formula. (J.R.D.)

20877 APEX-519

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

ANALYSIS OF YTTRIUM METAL AND YTTRIUM OXIDE. [REPORT] NO. 1. COPPER, NICKEL, IRON AND MOLYBDENUM. J. O. Hibbits, W. F. Davis, and M. R. Menke. Sept. 1959. 22p. Contracts AF33(600)-38062 and AT(11-1)-171. $0.75(OTS).

A method of analysis of yttrium metal and yttrium oxide for the determination of trace amounts of copper, nickel, iron, and molybdenum is reported. These impurities were separated from yttrium by liquid-liquid extraction. No difficulties were encountered in the determination of copper, nickel, or iron. Some difficulty was experienced in the determination of molybdenum when large quantities of copper also were present. Several washings were necessary to clear up the turbidity caused by the precipitation of the copper as cuprous thiocyanate. (auth)

20878 CF-52-8-218

Oak Ridge National Lab., Tenn.

SEPARATION FACTOR AND TRANSFER COEFFICIENTS ASSOCIATED WITH ION EXCHANGE SEPARATION OF ENRICHED AS-DEPLETED AS. S. H. Jury. Aug. 15, 1952. Decl. Dec. 17, 1958. 14p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

Ion exchange separation factor equations are derived for the Dowex $As_e - As_d$ system. (W.L.H.)

20879 CF-53-12-110

Oak Ridge National Lab., Tenn.

DISTRIBUTION OF RADIOELEMENTS IN A QUALITATIVE ANALYSIS SCHEME. M. M. Vick and S. A. Reynolds. Dec. 18, 1953. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The distribution of radioelements in the qualitative analysis scheme of West et al., (Qualitative Analysis and Analytical Chemical Separations, MacMillan, New York, 1953) was determined by the use of group carriers. Results are tabulated. (J.R.D.)

20880 CF-59-8-122

Oak Ridge National Lab., Tenn.

EQUILIBRIUM CALCULATION IN THE SYSTEM: URANYL NITRATE, NITRIC ACID, WATER, TBP, AND KEROSENE DILUENT USING THE ORACLE DIGITAL COMPUTER. S. H. Jury and M. E. Whatley. Aug. 12, 1959. 28p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

A set of equations was written which allowed the calculation of equilibrium concentrations in the solvent phase of nitric acid and uranyl nitrate, given the initial TBP concentration in the solvent and the aqueous phase

concentrations of acid and uranium. An ORACLE subroutine was written based on these equations which will calculate a set of equilibrium values in about 35 milliseconds. The subroutine was incorporated into a short program to calculate equilibrium points. A set of calculated points are presented in graphical form for 5, 20, 30, 40, and 100% TBP for nitric acid concentrations up to 7 M and uranyl nitrate concentrations up to 0.6 M in the aqueous phase. Since these calculations were based on limited data, it is the purpose of this memo to invite comment on their accuracy. The equations were reworked from a Russian paper by A. M. Rozen and L. P. Khorkhorina, using emperical polynomial fits for some poorly defined parameters, and were based principally on data from J. W. Codding. This project was undertaken to provide a subroutine to calculate equilibria in a general purpose ORACLE program to calculate the performance of multi-stage compound extraction cascades with more than one significant solute. (auth)

20881 CRRP-761(Pt.B)

Atomic Energy of Canada Ltd., Chalk River, Ont.

CHEMICAL AND ISOTOPIC ANALYSIS OF IRRADIATED URANIUM SLUGS FROM DEMOUNTABLE SLUG ROD. A.G.W.-1 (P-4498). R. G. Hart, M. Lounsbury, C. B. Bigham, L. P. V. Corriveau, and F. Girardi. Sept. 1959. 27p. (AECL-813). $1.00(AECL).

Uranium samples 6 in. × 1.36 in. were irradiated to various levels in the NRX Reactor for studies of the variation of reactivity of natural uranium with neutron irradiation. Results of chemical and mass-spectrometric analyses of the samples are presented. The samples were analyzed for total U, total Pu, U isotopic composition, and Pu isotopic composition. (W.D.M.)

20882 GAT-285

Goodyear Atomic Corp., Portsmouth, Ohio.

THE DETERMINATION OF URANIUM AND MOLYBDENUM BY SELECTIVE PRECIPITATION WITH 8-HYDROXYQUINOLINE. L. E. Storms. July 21, 1959. 13p. Contract AT(33-2)-1. $0.50(OTS).

A procedure was developed for the quantitative separation of uranium and molybdenum by selective precipitation with 8-hydroxyquinoline in the presence of versene. The uranium is precipitated from an ammoniacal solution containing molybdenum, and the molybdenum is precipitated from the filtrate by adjusting the pH with acetic acid after the addition of ammonium acetate. The procedure was found applicable for the determination of uranium and molybdenum in the solutions resulting from the hydrolysis of the hexafluorides. For an approximately equal mole mixture of the hydrolyzed hexafluorides, a precision of ±0.14 mole % molybdenum hexafluoride can be expected. The limit of error for the average of three duplicate determinations will be ±0.08 mole % molybdenum hexafluoride. The absolute error in determining the mole % molybdenum hexafluoride is estimated to be ±0.25%. (auth)

20883 GAT-T-687

Goodyear Atomic Corp., Portsmouth, Ohio.

INFRARED SPECTRA OF ClO_2, ClO_2F, AND ClO_3F. E. A. Smith, F. C. Steinbach, and K. E. Beu. Oct. 5, 1959. 6p. Contract AT(33-2)-1. $1.80(ph), $1.80(mf) OTS.

The infrared spectra of ClO_2, ClO_2F, and ClO_3F are given. A procedure for the identification of ClO_2 in the presence of ClO_2F is also outlined. (auth)

20884 HW-25035

Hanford Works, Richland, Wash.

ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. VI. THE COPPER SPARK METHOD. T. K. Bierlein, L. F. Kendall, and H. H. Van Tuyl. July 25, 1952. Decl. July 1, 1959. 24p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

In the copper spark method for the determination of trace impurities, the sample in hydrochloric acid solution is evaporated on copper electrodes which are sparked to produce the impurity spectra. Investigations of variables affecting sensitivity, electrode preparation, excitation conditions, and evaluation of spectra are discussed. With very careful control of all variables, precisions on the order of ±2% at the 99% limits can be obtained. A stepwise procedure for the semiquantitative analysis of solutions containing small amounts of plutonium is included. (auth)

20885 HW-60552

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SEQUENTIAL SEPARATION OF SOME ACTINIDE ELEMENTS BY ANION EXCHANGE. F. P. Roberts and F. P. Brauer. June 1, 1959. 9p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

Methods are presented by which trace amounts of several actinide elements are separated. Use is made of the large differences in distribution coefficients, so careful chromatographic techniques are not necessary. Small columns are used, allowing the desired constituent to be obtained in 10 ml or less. One method is used to separate americium, plutonium, and neptunium. These elements are sequentially eluted from columns of Dowex 1 resin in that order by 8 M HNO_3, 0.02 M ferrous sulfamate in 4.5 M HNO_3, and 0.001 M ceric sulfate in 0.25 M HNO_3. Another method is used to separate americium, thorium, plutonium, and neptunium sequentially in that order by 8 M HNO_3, 12 M HCl, 12 M HCL–0.1 M NH_4I, and 4 M HCL by elutriation. Protactinium and uranium follow the americium in both methods. The methods presented are characterized by a low degree of cross contamination. Yields are greater than 95 percent. (auth)

20886 HW-61179

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A REMOTE PHASE SEPARATION BULB FOR HIGHLY RADIOACTIVE SAMPLE ANALYSES. M. H. Campbell. [July 21, 1959]. 12p. $3.30(ph), $2.40(mf) OTS.

The separation bulb was designed to handle hot samples with a minimum of operator exposure. The separation bulb is an adaptation of an undocumented reaction vessel designed for colorimetric phosphate determination. A detailed description is given of the bulb and its operation. (W.L.H.)

20887 IGO-AM/S-195

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE GRAVIMETRIC AND VOLUMETRIC DETERMINATIONS OF TOTAL RARE EARTH OXIDES, CERIUM OXIDE, SILICA AND THORIA IN MONAZITE SAND. Mar. 31, 1959. 11p.

The rare earths and thorium are extracted with concentrated sulfuric acid and separated by precipitation as hydroxide and then as oxalate. The oxalates are ignited to oxides and weighed as such. The oxides are dissolved in sulfuric acid. The cerium is oxidized with ammonium persulfate and determined by titration with ferrous ammonium sulfate solution and standard potas-

sium dichromate solution. The insoluble material from the initial sulfuric acid attack contains all the silica. It is ignited and fused with potassium hydrogen sulfate. The cooled melt is leached with dilute nitric acid and the insoluble matter, containing all the silica, separated by filtration. The residues are ignited in a platinum crucible and the silica determined by the hydrofluoric acid procedure. Thoria is determined by extracting the thorium from monazite sand with sulfuric acid, and after double precipitation as iodate, the thorium is precipitated as oxalate using oxalic acid. The filtered precipitate is ignited and weighed as thoria. The residue after extraction with sulfuric acid, is fused with potassium hydrogen sulfate and is treated in a similar manner. (auth)

20888 IGR-174(O/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF SODIUM, LITHIUM AND POTASSIUM IN MERCURY. June 12, 1959. 9p. $0.25(BIS).

The mercury is shaken vigorously with dilute hydrochloric acid to extract the sodium, lithium, and potassium. The extract is then vaporized and burned in an atomizer-burner attached to a spectrophotometer. The method is applicable to the determination of sodium, potassium, and lithium in mercury containing from 2 to 50 μg/100g of sodium, 5 to 50 μg/100g of potassium, and 5 to 50 μg/100g of lithium. Concentrations outside these ranges can be determined by suitable adjustment of sample aliquot. (auth)

20889 IGR-175(O/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF NON-VOLATILE MATTER IN MERCURY. June 12, 1959. 5p. $0.17(BIS).

The mercury is distilled under reduced pressure and the residue determined by difference in weight. The method is applicable to the determination of non-volatile matter in mercury containing not less than 0.001% non-volatile residue. (J.E.D.)

20890 K-1430(Vol. II)

Oak Ridge Gaseous Diffusion Plant, Tenn.

SOME THERMODYNAMIC PROPERTIES OF FREON-114. VOLUME II. THE CRITICAL TEMPERATURE TO 400°F. N. H. Van Wie and R. A. Ebel. Sept. 3, 1959. 28p. Contract W-7405-eng-26. $1.00(OTS).

Specific volume, specific heat, enthalpy, and entropy for dichlorotetrafluoroethane are tabulated over the temperature range above the critical temperature to 400°F. (C.J.G.)

20891 LAMS-1954

Los Alamos Scientific Lab., N. Mex.

ESTIMATED UPPER BOUNDS TO THE HALF-LIFE OF THERMAL DECOMPOSITION OF AMMONIA, HYDROGEN, METHANE, AND PROPANE. Dudley Herschbach. Aug. 1955. Decl. Aug. 11, 1959. 30p. Contract W-7405-eng-36. $4.80(ph), $2.70(mf) OTS.

An estimate was made of the upper bound for the half-time of dissociation at 100 atm. for ammonia, methane, and propane at 2800°K and hydrogen at 5000°K. In each case a unimolecular reaction in the homogeneous gas phase was chosen as most suitable for this purpose. Slater's theory has been used to estimate the necessary frequency factors. The upper bounds to the half-time for dissociation range from 3×10^{-7} to 6×10^{-4} sec. Extrapolation of decomposition rate data obtained at ~1000°C and 1 atm. pressure gives smaller values for the half-time of dissociation. (auth)

20892 LAMS-1974

Los Alamos Scientific Lab., N. Mex.

PROCESS DEVELOPMENT OF 2,2-DINITROPROPYL ACRYLATE. T. M. Benziger, R. K. Rohwer, and W. H. Stein. Oct. 1955. Decl. Sept. 25, 1959. 45p. Contract W-7405-eng-36. $7.80(ph), $3.30(mf) OTS.

Pilot-plant production of 2,2-dinitropropyl acrylate (DNPA) is described. This compound is prepared by conversion of nitroethane to 2,2-dinitropropanol using the Schechter-Kaplan reaction and subsequent esterification of the alcohol with acrylic acid using polyphosphoric acid as condensing medium. A method for the bulk polymerization of DNPA is outlined. (C.W.H.)

20893 NAA-SR-3827

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THERMODYNAMIC PROPERTIES OF SOLID BISMUTH CHLORIDES. A. J. Darnell and S. J. Yosim. Sept. 15, 1959. Contract AT(11-1)-GEN-8. $0.50(OTS).

The thermodynamic stability of solid BiCl with respect to its disproportionation products, Bi(s) and $BiCl_3$ (g), has been determined from 127 to 242°C. This was accomplished by measuring the pressure of $BiCl_3$ gas over the solid subhalide and over pure $BiCl_3$ by the Knudsen technique. The pressures of $BiCl_3$ from the sublimation and disproportionation reactions are respectively: $\log P^0_{BiCl_3} = -(6200 \pm 30/T) + 9.95 \pm 0.07$ and $\log P_{BiCl_3} = -(6360 \pm 60/T) + 9.29 \pm 0.14$. These results show that the subchloride is barely stable with respect to its solid disproportionation products. At 298°K the ΔH^0, ΔF^0, and ΔS^0 of formation of BiCl(s) are respectively −30.4 kcal/mole, −24.0 kcal/mole, and −18.0 e. u. New values for ΔF^0_{form}, ΔS^0_{form}, and S^0 of $BiCl_3$(s) were calculated and are respectively: −73.6 kcal/mole, −57.1 e. u., and 36.4 e. u. (auth)

20894 NAA-SR-Memo-2412

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SOLUBILITY OF TERPHENYLS AT ROOM TEMPERATURE. R. T. Keen. Jan. 8, 1958. 4p. $1.80(ph), $1.80(mf) OTS.

The solubilities of ortho-, meta-, and para-terphenyl at room temperature in various solvents were measured. (W.D.M.)

20895 NYO-7935

Aeroprojects, Inc., West Chester, Penna.

PARTICLE SIZE REDUCTION DURING ULTRASONIC PRECIPITATION OF THORIUM OXALATE. J. L. Straughn and W. B. Tarpley. June 1959. 51p. Contract AT(30-1)-1836. $9.30(ph), $3.60(mf) OTS.

An experimental investigation of applied ultrasonic vibration during thorium oxalate precipitation was conducted to determine the possibility of achieving smaller size, narrow size range, and freedom from exacting precipitation conditions. Several precipitation vessels were examined with various means of coupling the ultrasonic energy mechanism to the chemical reaction system. It was found that the converging coupler design was the most effective. Both batch methods and continuous-flow jet precipitation were investigated. Among the variables studied were frequency, power, temperature, concentration of chemical components,

time of ultrasonic application, processing flow rates, and mode of addition of the reagents. Evaluation was carried out by microscopic examination, gravity sedimentation, and Whitby centrifuge analysis. In all cases, ultrasonic application reduced particle size and increased the uniformity of the particle size in contrast with other forms of agitation. The influence of chemical conditions was found to be less restrictive when ultrasonic activation was utilized during precipitation. (auth)

20896 NYO-8026
Tufts Univ., Medford, Mass.
THE SYSTEM LITHIUM HYDRIDE–CALCIUM HYDRIDE. Charles E. Messer and John A. Krol. Sept. 21, 1959. 12p. Contract AT(30-1)-1410. $3.30 (ph), $2.40(mf) OTS.

The solid-liquid equilibrium diagram of the system lithium hydride–calcium hydride was investigated by thermal analysis from 0 to 37.2 mole % CaH_2. The system showed a eutectic at 18.3 ± 0.5 mole % CaH_2 and 614°C. From behavior of time of eutectic halt as a function of composition, solid solubility of CaH_2 in LiH at the eutectic temperature was indicated as 0.4 ± 0.4 mole % CaH_2. Solution energy calculations indicate the possibility of such solid solubility, rather high in view of the large ionic size of Ca^{2+} as compared with Li^+ However, limitations in the apparatus and approximations in the calculations are such that the significance of this solubility value cannot be decided on the basis of the current work alone. (auth)

20897 RFP-139
Dow Chemical Co. Rocky Flats Plant, Denver.
VOLUMETRIC ANALYSIS OF URANIUM METAL. J. L. Long. Sept. 24, 1959. 12p. Contract AT(29-1)-1106. $0.50(OTS).

A precise and rapid method for the volumetric assay of uranium metal has been developed. The method consists of dissolving a weighed sample in an aqueous mixture of hydrochloric, sulfuric, and fluosilicic acids. The resulting uranium solution is titrated without a subsequent reduction step. (auth)

20898 SCS-Memo-1
Gt. Brit. Springfields Works, Springfields, Lancs, England.
RUBIDIUM AS AN INTERNAL STANDARD IN THE SPECTROGRAPHIC ESTIMATION OF LITHIUM, POTASSIUM AND BARIUM. P. A. Serin. June 29, 1950. 5p.

The use of rubidium as an internal standard in the estimation of lithium, potassium, and barium in uranium-base materials by the carrier distillation technique has been investigated; no improvement in the reproducibility of the results was observed, compared with the present method of direct determination using standard plates. (auth)

20899 WADC-TR-59-61
General Electric Co. Research Lab., Schenectady, N. Y.
RESEARCH ON POLYMERIC BONDING SYSTEMS AND THEIR DIELECTRIC BEHAVIOR. Period covered: March 1958 to December 1958. R. P. Anderson and M. M. Sprung. Apr. 1, 1959. 75p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: ANALOGIES BETWEEN DIELECTRIC ABSORPTION AND MECHANICAL DAMPING. Contract AF33(616)-5535.

As a method of studying the effects of reversible interchain bonding forces on the properties of polymers, simple borosiloxane and borosiloxanes containing nitrogen functions in the side chain (capable of coordinate bonding with the boron) have been investigated. This has involved the synthesis of borane and silane intermediates and the formation of borosiloxanes from them. (auth)

20900 WAPD-CTA(GLA)-157(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF TITANIUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. D. V. Reed. May 14, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

In concentrated sulfuric acid, 5-sulfosalicylic acid forms a yellow complex with titanium which is measured spectrophotometrically at 450 mμ. The color is stable for at least 24 hours. Positive interferences from iron and vanadium are negligible provided the material contains less than 0.2% iron and 100 ppm of vanadium. Fluoride from hydrofluoric acid dissolution is reduced to a non-interfering level by fuming the sample with sulfuric acid. The interference of colored ions is corrected for through the use of a sample solution blank. The method covers the determination of 10 to 100 ppm of titanium on a one gram sample basis. (auth)

20901 WAPD-CTA(GLA)-162-5(Rev. 3)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROCHEMICAL DETERMINATION OF ALUMINUM AND COPPER IN ZIRCONIUM AND ZIRCALOY USING D.C. ARC EXCITATION AND A BARIUM FLUORIDE FLUX. R. M. Jacobs, R. F. Farrell, and T. F. Anater. July 21, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

This method is used for the spectrochemical analysis of zirconium and Zircaloy oxides for aluminum and copper. The concentration ranges covered are as follows: aluminum, 10 to 300 ppm; copper, 10 to 200 ppm. All samples are ignited in a laboratory muffle furnace at 900°C. The oxides are mixed with a barium fluoride-graphite buffer and are then exposed using d-c arc excitation. The spectra are recorded and measured by standard spectrographic practices. The measured line transmittances are converted to relative intensities and referred to analytical curves to obtain the elemental concentrations. (auth)

20902 WAPD-CTA-M(GLA)-701-2
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF THE SECONDARY IMPURITIES IN HAFNIUM BY EMISSION SPECTROGRAPHIC ANALYSIS. J. F. Frain and J. R. Ryan. Apr. 20, 1959. 7p. $1.80(ph), $1.80(mf) OTS.

A procedure for the determination of 12 impurity elements in a hafnium oxide matrix is described. The procedure is applicable to the analysis of hafnium which has been converted to the oxide. The elements and concentration ranges are tabulated. (J.E.D.)

20903 WAPD-M(GLA)-718
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE GRAVIMETRIC DETERMINATION OF HAFNIUM AND ZIRCONIUM IN HAFNIUM MATERIALS. (Tentative Method). T. M. Reinhold. Apr. 14, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

Hafnium and zirconium are precipitated by mandelic acid in a hydrochloric acid solution. The mandelates are ignited and weighed as combined oxides. This method covers the determination of the total of the two metals in raw or purified hafnium oxides, hafnium sponge, and refined metal. The method is accurate to about ±0.3% relative. (auth)

20904 AEC-tr-3765
POTENTIOMETRIC DETERMINATION OF HIGH MOLECULAR WEIGHT FATTY ACIDS AND FATTY ACID MIXTURES. Christine Sass. Translated by Margaret V. Colven from Fette, Seifen, Anstrichmittel 61, No. 2, 93-5(1959). 8p. (Includes original figures). $1.80(ph), $1.80(mf) JCL.

Potentiometric precipitation titrations with silver nitrate are proposed for the identification and quantitative determination of fatty acids and their mixtures from caprylic to stearic acids. The results are illustrated with titration curves. (auth)

20905 AEC-tr-3785
POLYMORPHISM OF LIQUIDS. V. T. Slavyanskii. Translated by A. L. Monks (Oak Ridge National Lab.) from Doklady Akad. Nauk, S.S.S.R. 58, 1077-9(1947). 6p. $1.80(ph), $1.80(mf) JCL or LC.

Data are presented on the variation of viscosity with temperature for the following substances: water, salol (phenyl salicylate), potassium nitrate, lead chloride, and barium chloride. Results suggest allotropic modifications in the liquid state. (C.W.H.)

20906 AEC-tr-3803
DETERMINATION OF INDOLE DERIVATIVES IN PLANT MATERIAL. I. COLORIMETRIC DETERMINATION OF ASCORBIGEN (L-ASCORBIC ACID) AND ITS CONTENT IN CERTAIN TYPES OF VEGETABLES. Miloslav Valenta, Milan Kutaček, and František Icha. Translated for Argonne National Lab. from Sborník Československ. akad. zemědělských věd, Rostlinná výroba 2, 193-202(1956). 11p. $1.80(ph), $1.80(mf) JCL.

A method is described for the colorimetric determination of ascorbic acid in plant material. (C.H.)

20907 AEC-tr-3818
FLAME AND ATOMIZER. C. Th. J. Alkemade. Translated for Oak Ridge National Lab. from Chem. Weekblad 48, 699-703(1952). 18p. $3.30(ph), $2.40(mf) JCL.

A general characterization of flames and atomizers with regard to their appearance in flame photometry is given. Particularly, the effects of ionization and self-absorption in flames are discussed. (auth)

20908 AEC-tr-3833
COMPLEXOMETRIC TITRATIONS (CHELATOMETRY). XIII. THE DETERMINATION OF SCANDIUM. L. Wünsch. Translated by Maynard A. Hiller (Ames Lab.) from Collection Czechoslov. Chem. Communs. 20, 1107-12(1955). 15p. $3.30(ph), $2.40(mf) JCL or LC.

Conditions for the direct and indirect complexometric determination of Sc with Eriochrome Black T as indicator are outlined. The application possibilities of other indicators are also discussed. By masking with cyanide and dimercaptol, it is possible to determine Sc in the presence of several other elements. Procedures are given and typical analytical results are tabulated. (J.R.D.)

20909 CEA-tr-X-142
ETUDES RÉCENTES FAITES À L'ÉTRANGER SUR LES CATHODES À OXYDES. 2. RÉSUMÉ. (Recent Studies Made Abroad on Oxide Cathodes. 2. Résumé.) T. Imai. Translated into French by S. S. Minn from Ôyô Butsuri 26, No. 4, 139-46(1957). 7p.

A brief survey is made of the investigations of oxide cathodes. The resistance of the intermediate layer, effect of the nature of the metal on the cathode life, determination and evaporation of free barium, crystallographic constants of BaO, electric conduction, and the "hollow" type cathode are considered. (J.S.R.)

20910 CEA-tr-X-148
SÉPARATION DE TELLURE D'AVEC L'IODE PAR EXTRACTION DANS LE PHOSPHATE DE TRIBUTYLE 100 POUR CENT. (Separation of Tellurium from Iodine by Extraction with 100% Tributyl Phosphate.) Mariko Inarida (Inanida). Translated into French by S. S. Minn from Nippon Kagaku Zasshi 79, 721-3(1958). 11p.

The use of 100% TBP in the solvent extraction of iodine from tellurium was investigated. The study showed that the addition of hydrogen peroxide to an aqueous solution with an HCl concentration of 0.2N oxidizes the iodine ions which can then be completely extracted with 100% TBP. If the aqueous layer is then adjusted to 4N, a new extraction with 100% TBP removes the Te^{4+} ions, and the Te^{6+} ions remain in the aqueous layer. The three ions can thus be separated quantitatively. (tr-auth)

20911 NP-tr-278
ON THE SURFACE ACTIVITY OF CHARCOAL. B. G. Šimek and R. Kassler. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment) from Mitt. Kohlenforsch. Insts. Prag 2, 142-9(1935). 10p. $1.80(ph), $1.80(mf) JCL.

The properties of charcoal which might cause or affect spontaneous ignition were investigated. The test samples did not change appreciably during 2 to 7 days in air, and moist adsorbed gases did not greatly affect their spontaneous inflammability. The heat of adsorption liberated in adsorption of air moisture is insufficient to raise cold charcoal to the ignition point. Data on the heat of wetting and surface activity are included. (J.R.D.)

20912 NP-tr-290
ION EXCHANGE RESINS USED FOR ANALYSIS. REPORT NO. 8. SEPARATION OF IONS USING THE DIFFERENCE IN ADSORBABILITY DUE TO ELECTRIC CHARGE (MUTUAL SEPARATION OF Li^{+}, Be^{2+} AND Al^{3+}). Masatake Honda. Translated from Nippon Kagaku Zasshi 71, 118-20(1950). 5p.

Separation of Be^{2+} and Al^{3+} was investigated. Li^{+} was added as a representative of monovalent ions, and to verify the complete adsorption of all cations in the resin layer. The procedure is summarized. It was concluded that while the results were as expected, further study on the maximum amounts of starting solution in relation to the quantity of resin used, and on the selection of bivalent eluents is indicated. (J.R.D.)

20913 TT-825
SPECTRAL DETERMINATION OF IRIDIUM, PLATINUM AND PALLADIUM IN REFINED RHODIUM. (Spektral'noe Opredelenie Iridiia Platiny i Palladiia v Affinirovannom Rodii.) A. B. Babaeva and E. S. Lapir. Translated by G. Belkov (National Research Council of Canada) from Izvest. Sektora Platiny i Drug. Bladorod. Metal. Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R., No. 22, 145-8(1948). 8p.

A study was made of a method for the quantitative spectrographic analysis of rhodium in the presence of iridium, platinum, and palladium. The method consists in converting rhodium to a soluble triamine chloride salt for separation from the other metals. (J.E.D.)

20914 TT-826
SPECTRAL DETERMINATION OF SMALL QUANTITIES OF PLATINUM AND PALLADIUM IN REFINED SIL-

VER. (Spektral'noe Opredelenie Malykh Kolichestv Platiny i Palladia v Affinirovannom Serebre.) A. V. Babaeva and E. S. Lapir. Translated by G. Belkov (National Research Council of Canada) from Izvest. Sektora Platiny i Drug. Blagorod. Metal. Inst. Obschei i Neorg. Khim., Akad. Nauk S.S.S.R. No. 23, 97-100(1949). 7p.

Spectral analysis was used for determining platinum and palladium in silver. The source of illumination was a variable current arc with an activator. This source of excitation was found convenient since it is stable at high intensity and the results are readily reproducible. (J.E.D.)

20915 UCRL-Trans-487

INTERNAL ROTATIONS OF ETHANE AND PROPANE MOLECULES. Au-Chin Tang and Zee-Yuan Sher. Translated for Univ. of Calif., Lawrence Radiation Lab. from Tung Pei Jen Min Ta Hsueh-Tzu Jan K'o Hsueh Hsueh Pao 2, 69-80(1957). 12p. $3.30(ph), $2.40(mf) JCL.

Potential functions for ethane and propane molecules were calculated theoretically by using multicenter integrals based on quantum mechanics. The accuracy of the calculations was evaluated by comparison with experimental data. The results supported the Pitzer equation for ethane molecules, and pointed out the incompleteness of this equation for propane. (J.R.D.)

20916

ION-EXCHANGE SEPARATION OF CERIUM AND THORIUM WITH LEAD-EDTA COMPLEX AS ELUTING AGENT. Tomitsugu Taketatsu (Kyushu Univ., Fukuoka). Bull. Chem. Soc. Japan 32, 291-3(1959) Mar.

The separation of cerium and thorium ions was studied with a lead-EDTA complex solution as eluant. The optimum conditions were determined as the following: the concentration of the lead-EDTA solution was 0.015 mole, pH 3.0 and the flow rate 1.0 ~ 1.5 ml/min. Thorium ions were completely eluted with 200 ml of the eluant at the optimum conditions, while no cerium ions were detected in the effluent with 1000 ml of the eluant. Thus the use of a lead-EDTA complex solution as eluant was concluded to be effective for separation of cerium and thorium ions. (auth)

20917

ION EXCHANGE CHROMATOGRAPHY. M. J. Cabell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chem. in Can. 11, No. 4, 25-30(1959) Apr.

A description is presented of the two main methods used in ion exchange chromatography, break-through and elusion. Accounts of how these separations are controlled by the solution chemistry of the particular process chosen and the way various factors influence the course of a column separation are given. Two examples of ion exchange separation are described, the first being an application to a research problem in which it was necessary to separate sub-microgram amounts of materials and the second being a description of a process which is used on a large scale as an industrial operation. (auth)

20918

METHYLCYCLOHEXANON—NEW SOLVENT FOR THE EXTRACTION OF URANIUM AND FOR THE SEPARATION OF URANIUM FROM THORIUM. K. Seidl and M. Beranek. Chem. listy 52, 337-9(1958). (Translated from Referat. Zhur. Khim. No. 24, 1958, Abstract No. 82208.)

The separation of U is achieved from the water solution without the addition or in the presence of $NaCO_3$ and HNO_3. It was established that the best salting-out reagent is $NaNO_3$, while in the presence of HNO_3 the separation is impaired. The re-extraction of a U salt from methylcyclohexanone with the aid of a saturated caustic solution yielded 99.9% of the original quantity. Advantages of methylcyclohexanone, compared to other reagents employed are listed. (auth)

20919

SEPARATION AND APPLICATION OF THE STABLE ISOTOPES. PART II. PREPARATION OF GAS SAMPLES FOR THE MASS-SPECTROMETRIC DETERMINATION OF ISOTOPE CONTENT. I. Maas. Chem. Tech. (Berlin) 10, 17-22(1958). (Translated from Referat. Zhur. Khim. No. 24, 1958, Abstract No. 82218.)

Methods of refining substances with the purpose of obtaining samples for isotopic analyses based on hydrogen, carbon, nitrogen, and oxygen balances are reviewed. (auth)

20920

THE MECHANISM OF THE ELECTROLYTIC REDUCTION OF MnO_4^-; $SeO_4^=$; ReO_4^- IONS WHEN LIBERATED TOGETHER WITH CHROMIUM. D. N. Usachev, N. L. Klimasenko, and A. T. Vagramyan (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 838-9(1959) Aug. 1. (In Russian)

The theory and practice of electrolytic chromium plating are described. The electrolysis of potassium permanganate in chromium oxide solution at 20° and 0.1 a/cm^2 current density showed that from a liter solution of 2 M CrO_3, 0.02 M H_2SO_4, and 0.25 M $KMnO_4$ the chromium–manganese alloy precipitation contains 15% Mn and 85 Cr. The potential of $SeO_3 + 4e \rightleftharpoons Se$ equals +0.74 v, and it was expected that Se would be precipitated with chromium on the cathode. A standard chromium electrolyte containing 2.5 mole/l CrO_3 and 0.025 mole/l H_2SO_4 was used with selenide introduced as H_2SeO_4. The deposition at 20° and 0.50 a/cm^2 current density contained 63% Cr and 37% Ce. Similar results were obtained with potassium perrhenate. Qualitative analysis of the deposition showed the presence of rhenium, confirming the use of the method for the electrolytic reduction of ReO_4^- ion with chromium. (R.V.J.)

20921

MECHANISM OF ISOTOPIC EXCHANGE IN MOLECULAR HYDROGEN ON PLATINUM FILMS. G. K. Boreskov and A. O. Vasilevich (Karpov Scientific Research Inst. of Physics and Chemistry). Doklady Akad. Nauk S.S.S.R. 127, 1033-6(1959) Aug. 11. (In Russian)

Effects of temperature, pressure, and depth of adsorption on isotopic exchange between hydrogen, deuterium, and tritium in atomic and molecular states are studied. The design of the experimental installation and graphs of isotopic exchange rates are included (R.V.J.)

20922

REDUCTION OF NITRATE IONS IN THE PRESENCE OF SMALL CONCENTRATIONS OF LANTHANUM IONS. Lu Shou-zhun and S. I. Zhdanov (Inst. of Electrochemistry, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 1051-4(1959) Aug. 11. (In Russian)

The effect of $LaCl_3$ concentration on the reduction of NO_3^- ions was studied. Reduction in 0.1M KNO_3 begins at −1.55v in relatively low concentration. Additions of

$LaCl_3$ accelerate the process and the reduction begins at considerably less negative potentials. Additions of SO_4^{2-} slows the reduction in the presence of small concentrations of La^{3+}. (R.V.J.)

20923

PROTECTIVE COATINGS. Francis Scofield. Ind. Eng. Chem. 51, 1213-14(1959) Sept.

References to various reports and discussions on the use of catalyzed coatings, and water-thinned coatings are presented. (C.J.G.)

20924

THE CHEMICAL INDUSTRY—A NUCLEAR FUTURE? PART I. RADIOACTIVITY. W. R. Tomlinson, Jr. (Johns Hopkins Univ., Bethesda, Md.). Ind. Eng. Chem. 51, 1239-44(1959) Oct.

An analysis and evaluation of the future of the chemistry industry in the production and use of radioactive materials are discussed. The tremendous potential of radioisotopes for future industrial applications is discussed in relation to economic nuclear power. (C.J.G.)

20925

EFFECT OF CHEMICAL TREATMENT ON THE STRUCTURE AND PROPERTIES OF GRAPHITE. S. Ray (Indian Assn. for the Cultivation of Science, Calcutta). Indian J. Phys. 33, 282-3(1959) June.

The structural change of graphite crystals after hydrochloric and hydrofluoric acid chemical treatments was investigated by means of x rays. Small misalignments between basal planes were inhanced by the treatments. (C.J.G.)

20926

THE INCREASE IN ELECTRICAL RESISTANCE OF DIRECTLY HEATED CATHODES OF BORIDES OF RARE EARTH METALS. G. V. Samsonov, V. S. Neshpor, and T. I. Serebryakova (Inst. of Metalloceramics and Special Alloys, Kiev). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 2, 118-20 (1959) Feb. (In Russian)

Results are given of an experimental investigation of the sintering of mixtures of powdered lanthanum and cerium borides (LaB_6 and CeB_6) at various temperatures from 1600 to 2000°C. Results of the x-ray analyses are given. Data on specific electrical resistance are represented graphically. (auth)

20927

CHEMICAL ADSORPTION OF GASES ON NICKEL OXIDE AND ITS SOLID SOLUTIONS WITH LITHIUM OXIDE. N. P. Keier and L. N. Kutseva (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 5, 797-805(1959) May. (In Russian)

The kinetic relation of donor adsorption gases (CO and C_2H_2) and acceptor electron gases (O_2 and CO_2) on NiO and its solid solutions with Li_2O and Fe_2O_3 and triple solid solutions (NiO, Li_2O, and Fe_2O_3) was investigated. (R.V.J.)

20928

INVESTIGATION OF ZrO_2—Cr CERMETS. L. P. Kachalova and A. I. Avgustinik (Leningrad Tech. Inst. imeni Lensovet, U.S.S.R.). Izvest. Vysshikh Ucheb. Zavedeni. Khim. i Khim. Tekhonol. No. 5, 70-5(1958) Dec.

Using zirconium dioxide mixed with 20% or more of chromium powder, it was possible to prepare cermets which exhibit a high mechanical strength and a considerable heat resistance. Because the metal component of the cermet bears the strain involved in all the volume changes originating by reason of the high-temperature polymorphic transformations of the monoclinic zirconium dioxide, a stabilizing effect is produced. (auth)

20929

EVIDENCE FOR THE EXISTENCE OF PEROXYURANIC ACID. R. E. DeMarco, D. E. Richards, T. J. Collopy, and R. C. Abbott (National Lead Co. of Ohio, Cincinnati). J. Am. Chem. Soc. 81, 4167-9(1959) Aug. 20.

Uranium trioxide was treated with aqueous hydrogen peroxide to form a hydrated uranium peroxide compound identical to that precipitated from aqueous uranyl nitrate solution by the addition of hydrogen peroxide. The stoichiometric compound, $UO_4 \cdot 2H_2O$, was shown to react with alcoholic potassium hydroxide to form hydrated monobasic ($KHUO_5 \cdot xH_2O$) and dibasic ($K_2UO_5 \cdot xH_2O$) potassium salts. A hydrated peroxyuranic acid structure ($H_2UO_5 \cdot H_2O$) was concluded to best represent a compound of the stoichiometry $UO_4 \cdot 2H_2O$. This structure was supported by the infrared absorption spectrum and reactions with a strong base of the uranium peroxide compound. (auth)

20930

HIGH TEMPERATURE HEAT CONTENT AND ENTROPIES OF HAFNIUM TETRAFLUORIDE AND RUBIDIUM FLUORIDE. C. E. Kaylor, G. E. Walden, and Donald F. Smith (Univ. of Alabama, University). J. Am. Chem. Soc. 81, 4172-3(1959) Aug. 20.

Measurements of heat contents above 273°K were conducted for hafnium tetrafluoride and rubidium fluoride to temperatures of 1103 and 1199°K, respectively. Normal behavior was observed for both compounds. Heat content equations were derived and entropies calculated. (auth)

20931

THERMODYNAMICS FOR THE EXTRACTION OF URANYL NITRATE AND NITRIC ACID BY ESTERS OF THE TYPES $(RO)_3P = O$ AND $(RO)_2RP = O$. T. H. Siddall, III (E. I. du Pont de Nemours & Co., Aiken, S.C.). J. Am. Chem. Soc. 81, 4176-80(1959) Aug. 20.

The thermodynamic quantities, ΔH, ΔF and ΔS, were obtained for the extraction of uranyl nitrate and of nitric acid by twenty-one compounds of the types $(RO)_3P = O$ and $(RO)_2RP = O$. The values of ΔS suggest that a very open structure is retained by the extractant molecules when they are bound to uranyl nitrate. The strength of the bonds formed with the uranyl ion is substantially altered as substituents on the phosphorus atom are replaced by various radicals. A partial correlation with Kharasch's electronegativity scale was obtained for the substituents. When ΔF for the extraction of uranyl nitrate was plotted against ΔF for the extraction of nitric acid, a straight line was obtained. However, the fit of the data to the straight line is only approximate. Evidence was obtained that an extra order—disorder transition accompanies extraction of uranyl nitrate by certain extractants, but not with others. (auth)

20932

THE FLUORIDE COMPLEXING OF SCANDIUM(III) IN AQUEOUS SOLUTION: FREE ENERGIES, HEATS AND ENTROPIES. John W. Kury, Armine D. Paul, Loren G. Hepler, and Robert E. Connick (Univ. of California, Berkeley). J. Am. Chem. Soc. 81, 4185-9(1959) Aug. 20.

The complexing of Sc(III) in perchlorate solutions at an ionic strength of 0.5M was determined by studying the potential of the ferrous-ferric electrode as a function of the HF, H^+, and Sc(III) concentrations. The data can be interpreted by assuming the presence of the species ScF^{2+}, ScF_2^+, ScF_3(aq) and ScF_4^-. Equilibrium constants for the formation of these complexes at 15, 25, and 35° were evaluated and from them the heat and entropy changes of the reactions calculated. The scandium fluoride complexes are more stable than those of other trivalent ions of comparable radius. The extra stability of the complex scandium fluorides arises from an irregularity in the heat term, rather than in the entropy term. (auth)

20933

A UNIT FOR THE DETERMINATION OF URANIUM BY ETHER EXTRACTION. Zoltan Nagy and Gyula Almassy. Magyar Kém. Folyóirat 63, 359-60(1957). (Translated from Referat. Zhur. Khim. No. 13, 1958, Abstract No. 43134.)

A unit for the extraction of uranium with ether is described. The ether phase is drawn into a flask by means of a vacuum pump, the ether is distilled, in vacuum, through a condenser into another cooled flask, and the residue in the first flask is rinsed into an evaporation dish. Prior to distillation of the first ether extract it is necessary to draw in, by suction, approximately 20 ml of water to remove the possibility of an explosion. The unit includes no rubber connections, distillation proceeds rapidly, and most of the ether is recovered. (auth)

20934

INVESTIGATION OF THE ZIRCONIUM-MORIN COMPLEX; PHOTOMETRIC DETERMINATION OF ZIRCONIUM. A. Schneer and T. Halmos (Lorand Eotvos Univ. of Science, Budapest). Magyar Kem. Folyoirat 64, 371-6(1958) Oct.

The properties of the complex compound formed by zirconium with morin were investigated. This compound is light yellow, emits a green fluorescence in ultraviolet light, is readily soluble in water containing alcohol, and is stable in acidic solutions. It contains the two components in the molar ratio of 1:1. The apparent dissociation constant of the complex was calculated on the basis of a Job curve and found to have the value $K_d = 2.6 \times 10^{-5}$. This complex compound is suitable for the photometric determination of small quantities of zirconium. The optimum conditions for this determination were established. (auth)

20935

A CAPACITANCE METHOD FOR FOLLOWING VINYL POLYMERIZATIONS INITIATED BY γ-RAYS. G. J. K. Acres and F. L. Dalton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature 184, 335-7(1959) Aug. 1.

The deficiencies of dilatometric methods for studying vinyl radiopolymerization are pointed out and a capacitance method is described. A mercury column is connected to the reaction vessel and volume changes affect the mercury level as the reaction proceeds. A sheathed steel rod parallel to the Hg column is one side of a condenser of which the Hg is the other. A capacitance bridge measures changes in volume thereby. (T.R.H.)

20936

THE EFFECT OF THE CONCENTRATION ON THE VELOCITY OF THE ELECTROLYTIC PRECIPITATION AND DISSOLUTION OF ZINC AND CADMIUM IN SULFATE SOLUTIONS OF THESE METALS. S. V. Gorbachev and A. G. Atanasyants. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 430-4 (1958).

The cathodic and anodic polarization of zinc and cadmium were investigated over a wide range of concentrations of the corresponding sulfates. It was found that the cathodic and anodic polarizations decrease with increasing concentration. The velocity of the separation and dissolution of zinc and cadmium in relation to the concentration of the single neutral salts (the sulfates) of the corresponding metals were also investigated. The investigations were carried out at a constant polarization potential at 20 to 80°C. They showed that the velocity of the two processes increase proportionally to the concentration of the dissolved salt. Experimental results obtained are presented graphically. (auth)

20937

THE IONIC INTERACTION OF TRIVALENT THALLIUM AND IODIDE. THE THALLIUM IODIDE COMPLEXES. A. I. Busev and V. G. Tiptsova. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 486-90(1958).

The reaction between the trivalent thallium ion and iodide ion was investigated. Addition of dilute acid solutions of $Tl_2(SO_4)_3$ to iodide solutions initiated the reaction $Tl^{3+} + 2I^- \rightleftharpoons TlI^+ + I_2$; $I_2 + I^- \rightleftharpoons I_3^-$; $TlI^+ + I^- \rightleftharpoons TlI_4^-$. Thallium is determined titrimetrically according to the first reaction. A selective titrimetric method for the determination of small amounts of thallium (0.2 to 2.0 mg) with potassium iodide solution was worked out. Cadmium and mercury ions influence the titration since they also form complexes with iodine. (auth)

20938

THE DIRECT DETERMINATION OF PRASEODYMIUM IN MIXTURES WITH OTHER RARE EARTHS' ELEMENTS OF THE CERITE GROUP. M. N. Ambrozhii and A. M. Gol'tsev. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 491-4(1958).

A method for the determination of praseodymium using Mn-II-sulfate by the titration of the permanganate formed with oxalic acid is presented. By means of this method it is possible to determine the decomposition of the praseodymium oxide that forms by the thermal decomposition of nitrates and oxalates. It is shown that the praseodymium oxide obtained in the thermal decomposition of the nitrates has the formula $Pr_2O_3 \cdot 2PrO_2$. The praseodymium oxide produced by the thermal decomposition of the oxalates has the formula $Pr_2O_3 \cdot PrO_2$. (auth)

20939

KRYPTON IN A CAGE—CLATHRATE BETA SOURCES. D. J. Chleck and C. A. Ziegler (Tracerlab, Inc., Waltham, Mass.). Nucleonics 17, No. 9, 130-3(1959) Sept.

A new way of handling Kr^{85} consists of trapping the krypton in hydroquinone molecules to form a three-dimensional organic crystalline "cage" called a "clathrate." The cage is formed by crystallization from a melt under pressure, resulting in a stable source of beta particles. For use as a beta source the clathrate can be powdered into grains the size of salt or sugar. Safety in using the material results from its solubility. In the event of spill, water or ketones can be added to dissolve the organic crystal, thus permitting the inert krypton to escape harmlessly into the atmos-

phere. Applications of the clathrate are discussed. (C.J.G.)

20940

PREPARATION AND CRYSTALLOGRAPHIC PROPERTIES OF THE SYSTEMS $LaMn_{1-x}Mn_xO_{3+\lambda}$ AND $LaMn_{1-x}Ni_xO_{3+\lambda}$ JA-1106. Aaron Wold and Ronald J. Arnott (Massachusetts Inst. of Tech., Lexington). Phys. and Chem. Solids 9, 176-80(1959) Feb.

Lanthanum manganese oxides containing varying percentages of Mn^{4+} were prepared and their cell dimensions determined. Lanthanum manganese oxide, prepared under pure nitrogen, contained 0.02% Mn^{4+}. At room temperature it possessed orthorhombic symmetry and was the most distorted member of the series. The orthorhombic-to-rhombohedral transition points for members of this series have been determined, and the shape of the resulting curve interpreted on the basis of an ordering of four, coplanar empty orbitals of the Mn^{3+} ions and steric effects. The system $LaNi_xMn_{1-x}O_{3+\lambda}$ was prepared and its crystallographic properties studied. La_2NiO_4, $LaNiO_3$ and an intermediate lanthanum nickel oxide were prepared and their x-ray data are given. (auth)

20941

THE HEAT CAPACITIES OF SEVEN RARE-EARTH ETHYLSULPHATES AT LOW TEMPERATURES. Horst Meyer and P. L. Smith (Oxford Univ.). Phys. and Chem. Solids 9, 285-95(1959) Mar.

Heat-capacity measurements on the ethyl sulfates of lanthanum, cerium, praseodymium, neodymium, dysprosium, ytterbium, and yttrium between 1.4 and 20°K are described. In addition, specific heat results for the cerium salt between 0.6 and 1.2°K are presented. For the salts of lanthanum and yttrium, the specific heat is entirely due to lattice vibrations, while for those of neodymium and ytterbium, there is a small contribution from magnetic interaction, negligible above 2°K. For the salts of cerium, praseodymium, and dysprosium, a Schottky anomaly indicating the presence of excited electronic energy levels was found, and it was possible to determine the position of these levels with accuracy. The maximum of the Schottky anomaly of cerium and praseodymium ethyl sulfates was found to be somewhat larger than the one calculated from statistical mechanics, and this specific heat excess is discussed. (auth)

20942

THERMAL AND MAGNETIC PROPERTIES OF PRASEODYMIUM ETHYLSULPHATE BELOW 1°K. Horst Meyer (Oxford Univ. and Harvard Univ., Cambridge, Mass.). Phys. and Chem. Solids 9, 296-301(1959) Mar.

Single crystals of praseodymium ethyl sulfate were cooled below 1°K by adiabatic demagnetization and the susceptibility, expressed in terms of the magnetic temperature T, was measured as a function of T, using cerium magnesium nitrate as a thermometer. The specific heat was measured by electrically heating the sample. A systematic departure of the susceptibility from Curie's law and an anomaly in the specific heat were found. The results were interpreted and confirmed the existence of a variable splitting of the ground doublet, as predicted from paramagnetic-resonance experiments, with a root-mean-square value of $\Delta_0 = (0.53 \pm 0.04)$°K, which is much larger than the one in the diluted salt. (auth)

20943

A FEW EXAMPLES OF THE UTILIZATION OF RADIOISOTOPES IN THE GLASS INDUSTRY AND IN RELATED FIELDS. Jan Voldan. Sklář a keram. 7, No. 6, 170-5 (1957). (Translated from Referat. Zhur. Khim. No. 19, 1958, Abstract No. 65159.)

In a series of examples, the possibility is shown of using radioactive isotopes (RI) for the solution of some technological problems. For example, the use of RI of sodium, calcium, barium, and phosphorus permits an investigation of the flow of the glass mass in fire baths, the degree of homogenization, the period of melting, etc. (auth)

20944

PURIFICATION OF HIGH-TEMPERATURE PROCESS GASES IN A CENTRIFUGAL-FOAM DUST-CATCHER. V. P. Savrayev. Tsvetnye Metal. No. 1, 62-70(1959).

Some wet gas methods used in the purification of process gases are reviewed, and the disadvantages are indicated. A dust-catcher, based on the condensation of water vapor on the particles, is described. It consists of a cyclone connected to a frothing bubbler. The cyclone has a helical inlet and internal cylinders. Water from the bubbler passes through the cyclone. After successful laboratory tests, tests on zinc, lead, and copper plants with direct use of the heat content of gases for water evaporation were made. The performance is compared with that of high-speed turbulent dust catchers. (J.S.R.)

20945

THE APPLICATION OF PULSATING COLUMNS FOR SEPARATING URANIUM, DEGRADATION PRODUCTS AND PLUTONIUM BY THE COUNTER-CURRENT EXTRACTION METHOD. V. Dizdar. Tehnika (Belgrade) 13, No. 2, (1958). (Translated from Referat. Zhur. Khim. No. 1, 1959, Abstract No. 354.)

The process for separating uranium, the degradation products, and Pu by means of continuous counter-current extraction in pulsating columns is described. (auth)

20946

POTENTIOMETRIC METHOD OF DETERMINING ALUMINUM IN HEAT-RESISTANT ALLOYS ON A NICKEL BASIS. A. A. Gorelova and L. Y. Polyak. Zavodskaya Lab. 25, No. 3, 285-7(1959).

A potentiometric method for the determination of aluminum in nickel-base heat-resistant alloys was developed. The aluminum is titrated with sodium fluoride in a hydrochloric acid medium buffered with sodium acetate. An Al-Ni/Cr electrode is used. The interfering elements were determined, and methods of removing them were investigated. The method has a maximum error of ± 0.2%. (J.S.R.)

20947

THE QUESTION OF THE EXISTENCE OF MAGNESIUM BORIDE OF THE COMPOSITION Mg_3B_2. L. Ya. Markovskii, G. V. Kaputovskaya, and Yu. D. Kondrashev. Zhur. Neorg. Khim. 4, 1710-14(1959) Aug. (In Russian)

Experimental data are presented showing that there is no basis for postulating that Mg_3B_2 exists. (R.V.J.)

20948

STUDIES OF $NbCl_5-POCl_3$ AND $TaCl_5-POCl_3$. I. A. Sheka, B. A. Voitovich, and L. A. Nisel'son (Kalinin Moscow Inst. of Non-Ferrous Metals and Gold). Zhur. Neorg. Khim. 4, 1803-8(1959) Aug. (In Russian)

The crystal–liquid and liquid–vapor phase equilibria in $NbCl_5-POCl_3$ and $TaCl_5-POCl_3$ systems were stud-

ied. The melting points were 124.5° and 132.4°, respectively. The phase equilibria of liquid–vapor systems were determined at 760 mm mercury. It was also found that the interacting elements are azeotropic mixtures of $NbCl_5$: $POCl_3$ = 1.48:1 and $TaCl_5$: $POCl_3$ = 1.15:1 and the $TaCl_5 \cdot POCl_3$ is more thermally stable than $NbCl_5 \cdot POCl_3$. Thermoanalytical data showed the heats of dissociation about 3.3 kcal/mole. (R.V.J.)

20949

ON LANTHANUM AND CERIUM CHLORIDES WITH ETHYL ALCOHOL AND KETONES. Z. A. Sheka and E. E. Kress. Zhur. Neorg. Khim. 4, 1809-13(1959) Aug. (In Russian)

Complex compounds of lanthanum and cerium chlorides with ethyl alcohol of the type $LuCl_3 \cdot 3C_2H_5OH$ were prepared. It was found that in alcohol-benzol solutions the complexes interact with ketones and pyridine and one, two, and three (in case of pyridine) alcohol molecules are replaced. The interaction of cerium chloride alcohol complex with ketones is weaker than that of lanthanum chloride. The physico-chemical data on complex formation characteristics are included. (R.V.J.)

20950

COMPLEX FORMATION OF ZIRCONIUM AND HAFNIUM WITH TARTARIC ACID BY ION EXCHANGE. D. I. Ryabchikov, A. N. Ermakov, V. K. Belyaeva, and I. N. Marov. Zhur. Neorg. Khim. 4, 1814-28(1959) Aug. (In Russian)

The formation of Hf^{4+} and Zr^{4+} complexes with tartaric acid in perchloric acid solutions was studied and concentration limits were found for the types Me Tar^{2+} and Me Tar^{2+}. Formation constants are calculated. (R.V.J.)

20951

INTERATOMIC REACTIONS IN TITANIUM–GERMANIUM AND TITANIUM–SILICON SYSTEMS. N. V. Ageev, Yu. M. Golutvin, and V. P. Samsonov. Zhur. Neorg. Khim. 4, 1864-72(1959) Aug. (In Russian)

Heats of formation and heat capacities were plotted and lattice constants were determined for TiSi and TiGe. The data show the reduced chemical stability expressed as $TiSi \rightarrow Ti_5Si_3 \rightarrow TiSi_2$ and $TiGe \rightarrow Ti_5Ge_3 \rightarrow TiGe_2$; the bond stability for Ti_5Sn^3 is higher than Ti_3Sn. Correlations of atomic volumes and their increments in the systems showed electron transitions from silicon to titanium and from titanium to germanium, but electron transitions between titanium and tin were not observed. The tendency of the compounds toward peritectic reactions depends on their free energies and their position with respect to the free energy curve of the liquid phase, not on the bond stability of the compound. (R.V.J.)

20952

SOLUBILITY OF BORON IN SILICON. V. A. Epel'baum, M. A. Gurevich, and M. I. Starostina. Zhur. Neorg. Khim. 4, 1881-4(1959) Aug. (In Russian)

Boron in silicon reduces lattice spacing identity by certain solid solution replacement processes. The maximum diminishing of silicon lattice spacing appears with silicon-boron heating at 1350°C and 2100 to 2200°C, from 5.418 ± 0.0005kX (original silicon) to 5.405 and 5.401 kX, respectively. (R.V.J.)

20953

FUSIBILITY OF SYSTEMS OF TUNGSTATES AND FLUORIDES OF LITHIUM AND POTASSIUM. A. L. Keslova and A. G. Bergman. Zhur. Neorg. Khim. 4, 1893-8(1959) Aug. (In Russian)

The surface crystallization of ternary Li, K || F, WO_4 systems was studied by visual-polythermal methods. The congruently melting compound on the $KF \cdot K_2WO_2$ side becomes incongruent inside the system though the ridge is retained on the surface. The Li, K || F, WO_4 is completely analogous to the Li, K || F, SO_4 system. (R.V.J.)

20954

USPEKHI YADERNOY KHIMII. (Advances in Nuclear Chemistry.) Avgusta Konstantinovna Lavrukhina. Moscow, Izd-vo AN SSSR, 1959. 143p.

An historical sketch of the development of nuclear chemistry and the fundamental concepts of nuclear reactions as they apply to the transformation of chemical elements is presented. The general characteristics of radioactive disintegrations and nuclear reactions are described, and basic models of atomic nuclei and theories on nuclear forces are reviewed. Consideration is also given to descriptions of radiochemical methods of studying nuclear transformations, including beta-, alpha-, and gamma-spectroscopy, scintillation counting, and use of photographic emulsions. The role of slow particles in nuclear reactions and the influence of these particles on fission processes in heavy elements are discussed, as well as nuclear transformations caused by high-energy particles. Reaction products are also considered. Nuclear reactions on the sun, stars, and in space are described, and attention is given to the role of radioactive transformations in changes in the composition of isotopic elements of the earth's crust. The practical application of the principal advances in nuclear chemistry is reviewed with special emphasis on nuclear reactions which yield isotopes of transuranic elements and atomic power. Finally the problem of systematically classifying the nuclei of radioactive isotopes is considered. (auth)

20955

PRIMENENIYE RADIOAKTIVNYKH IZOTOPOV V ANALITICHESKOY KHIMII. (Use of Radioactive Isotopes in Analytical Chemistry.) I. P. Alimarin, ed. Moscow Izd-vo AN SSSR, 1958. 366p.

A collection of the principal papers presented in Moscow at the Second Conference on the Use of Radioactive Isotopes is presented. The problems discussed at the Conference included coprecipitation, aging, and solubility of precipitates, determination of the instability constants of complex compounds, separation of rare earth metals, and ion-exchange chromatography. 351 references. (auth)

20956

GAS CHROMATOGRAPHY, 1958. Proceedings of the Second Symposium Organized by the Gas Chromatography Discussion Group Under the Auspices of the Hydrocarbon Research Group of the Institute of Petroleum and the Koninklijke Nederlandse Chemische Vereniging held at the Royal Tropical Institute, Amsterdam, 19-23 May 1958. D. H. Desty, ed. New York, Academic Press Inc., 1958. 391p.

Twenty eight papers were presented at the symposium covering the following topics: theory of gas chromatography, techniques and apparatus, and applications. (W.L.H.)

20957

USING K-CAPTURE X-RAYS TO ANALYZE PRODUCTS IN THE PLANT. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–96. Alan

Beerbower (Esso Research & Engineering Co., Linden, N. J.). New York, Engineers Joint Council, 1959. 4p. $0.50.

A review is given of the K-capture process with a description in detail of equipment design and a discussion of sampling considerations. A successful use of the equipment for measuring ammonium chloride content in scrubbing tower wash water and for determining calcium (sulfated ash) content in the manufacture of petroleum products is described. (C.J.G.)

20958

ENCYCLOPEDIA OF CHEMICAL REACTIONS. VOLUME VIII. TUNGSTEN, URANIUM, VANADIUM, YTTERBIUM, YTTRIUM, ZINC, ZIRCONIUM, ADDENDA. C. A. Jacobson, comp. and Clifford A. Hampel, ed. New York, Reinhold Publishing Corporation, 1959. 540p.

This is the final volume of the Encyclopedia of Chemical Reactions. It includes entries on the reactions of W, U, V, Yb, Y, Zn, and Zr. Following these is a section comprising entries received subsequent to the publication of the earlier volumes containing reactions of the elements with which they are concerned. (W.L.H.)

Radiation and Radiochemistry

20959 AECU-4339

Michigan. Univ., Ann Arbor. Engineering Research Inst.

EFFECT OF GAMMA RADIATION ON THE KINETICS OF CHLORINATION OF SOME AROMATIC HYDROCARBONS. PART I. CHLORINATION OF MESITYLENE AND NAPHTHALENE. J. J. Martin, W. M. Sergy, J. F. Hanus, and J. Oishi. PART II. CHLORINATION OF ETHYL BENZENE. J. J. Martin, W. M. Sergy, and J. Oishi. PART III. CHLORINATION OF M-XYLENE AND METHYL NAPHTHALENES. J. J. Martin and W. M. Sergy. [1957]. 69p. $10.80(ph), $3.90(mf) OTS.

The effect of gamma radiation on the chlorination of mesitylene and naphthalene is presented. For mesitylene it was noted that the irradiated runs gave larger yields of the higher chloroderivatives than the nonirradiated runs. Also distillates from the irradiated runs were more clearly defined in boiling point range. Radiation yields for the chlorination of naphthalene were calculated in terms of G values based on chlorine. The G values for substitution are almost constant throughout the run at −5°C but show a comparatively high value during the early stages of the reaction at 5°C. The addition reaction at −5°C is virtually unaffected by radiation after 40 min. The over-all or average radiation yield for addition is almost identical at both temperatures. Kinetic data, radiation yields, and product analysis are presented for the chlorination of a highly purified ethyl benzene under the influence of radiation. The chlorination of M-xylene and methyl naphthalenes was investigated under the influence of radiation. (W.L.H.)

20960 BNL-544

Brookhaven National Lab., Upton, N. Y.

A UNIVAC PROGRAM FOR THE ANALYSIS OF RADIOACTIVE DECAY CURVES. Don S. Harmer. Mar. 1959. 11p. $0.50(OTS).

The Univac program was designed to find the initial activities in a multicomponent radioactive source by a least-squares analysis of conventional decay-curve data. The numerical values of the initial activities and error estimates are given directly by the calculation, along with other results needed to evaluate the reliability of the calculations. It is assumed that the decay constants (i.e., the half lives) are known for each of the components. The program can process a decay curve with 2 to 13 components (background may be treated as a component) and up to 999 observations. (auth)

20961 CEA-tr-X-62

MÉTHODE DE PRODUCTION DES FLUORURES UTILISABLES POUR LA RÉDUCTION MÉTALLOTHERMIQUE, PAR EXEMPLE DU TETRAFLUORURE D'URANIUM. (Method for the Production of Fluorides Usable for Metallothermal Reduction, for Example Uranium Tetrafluoride.) Translated into French from Swedish Patent 150,157. Inventor: J. H. Mogard. [Patent granted] May 31, 1955. 6p.

A method for the production of pure metallic fluorides which are to be used for the production of metals by metallothermal reduction is described. The metal oxide is caused to react with anhydrous hydrofluoride acid at a high temperature in a reactor which is lined with magnesium or entirely fabricated of magnesium. As magnesium is the metal most often used in the metallothermal reduction, no impurities are introduced into the fluoride. The production of uranium tetrafluoride is used as an example. (J.S.R.)

20962 CEA-tr-X-131

RADIO-CHIMIE DES COMPOSÉS INORGANIQUES. (Radiochemistry of Inorganic Compounds.) Yukio Murakami. Translated into French by S. S. Minn from Kōgyō Kagaku Zasshi 60, 813-21(1957). 11p.

The effects of radiation on inorganic compounds are divided into two categories: (a) ionization and excitation and (b) atomic displacement. A brief description is given of these effects. 96 references. (J.S.R.)

20963 UCRL-Trans-492

THE TENTH TRANS-URANIUM ELEMENT. V. I. Gol'danskii. Translated from Vestnik Akad. Nauk S.S.S.R., No. 1, 52-8(1959). 17p. (Includes original, 7p.). $3.30(ph), $2.40(mf) JCL or LC.

The element was produced by bombardment of Pu^{239} and Pu^{241} with O ions. A scheme and description of the experiments are given, and a review of efforts in several countries is included. (J.R.D.)

20964

THIODIGLYCOLIC ACID AS A REAGENT FOR ZIRCONIUM. Suseela B. Sant (Mt. Holyoke Coll., So. Hadley, Mass.) and Bharat R. Sant (Louisiana State Univ., Baton Rouge). Anal. Chim. Acta 21, 221-3(1959) Sept.

Thiodiglycolic acid is shown to be a suitable precipitating reagent for zirconium. The analysis is completed by igniting the precipitate and weighing the ZrO_2. Several metal ions do not interfere. Interference due to cerium(IV) is avoided by reducing it initially to cerium(III). Estimation of zirconium can be carried out in presence of thorium. The composition of the complex is slightly variable but corresponds to zirconyl thiodiglycolate. (auth)

20965

DIRECT ESTIMATION OF NIOBIUM BY N-BENZOYL-N-PHENYLHYDROXYLAMINE. A. K. Majumdar and A. K. Mukherjee (Jadavpur Univ., Calcutta). Anal. Chim. Acta 21, 245-7(1959) Sept.

N-benzoyl-N-phenyl hydroxylamine, with niobium, forms a complex of composition $NbO(C_{13}H_{10}NO_2)_3$ which is stable up to a temperature of 229°. Niobium can be

separated from tantalum and other elements as this complex and weighed directly after being dried at 110°. (auth)

20966

THE DETERMINATION OF NITROGEN IN METALS BY ISOTOPE DILUTION. H. Gene Staley and Harry J. Svec (Iowa State Coll., Ames). Anal. Chim. Acta 21, 289-95 (1959) Sept.

A wet chemical procedure for determining the amount of nitrogen in a metal or alloy has been developed which utilizes the isotope dilution technique. Ammonium sulfate, either enriched or depleted in N^{15}, is added to the metal sample during solution procedures. Ammonium ions resulting from the hydrolysis of bound nitrogen in the metals mix with that of the tracer and the total is then oxidized to N_2 in which form the element is analyzed in the mass spectrometer. The method has been tested on a variety of metals and alloys including thorium, lanthanum, yttrium, titanium, chromium, manganese, various steels, nickel–chromium, ferrotitanium, ferromanganese and ferrochromium. The range of nitrogen in these materials was from 2 ppm to almost 6%. Average precision was generally better than ±5%. (auth)

20967

CONSTITUTION AND PHYSICAL-CHEMICAL PROPERTIES OF SOME DOUBLE PHOSPHATES OF URANIUM AND ANALOGOUS SUBSTANCES. I. SYNTHESIS AND CHEMICAL COMPOSITION. F. González García and R. Romero Díaz (Facultad de Ciencias, Seville). Anales real soc. españ. fis. y quím. (Madrid), Ser B 55, 383-98(1959) May. (In Spanish)

A bibliographic review on the double uranyl-alkali phosphates and arsenates is given. The reaction between uranyl nitrate and potassium phosphate or arsenate solutions is studied. Several synthetic procedures are described, and the chemical compositions of the resulting compounds are determined. In the presence of sufficient K^+ concentration in the solution, the compound $KUO_2PO_4 \cdot 3H_2O$ or the corresponding arsenate is obtained. With a lower concentration of K^+, the substances obtained contain the hydrogen ion and have the general composition $(H,K)UO_2PO_4 \cdot xH_2O$. These compounds are transformed into the neutral potassium uranyl phosphate by treatment with potassium acetate solution. The relation between both classes of compounds are discussed. (auth)

20968

CONSTITUTION AND PHYSICAL-CHEMICAL PROPERTIES OF SOME DOUBLE PHOSPHATES OF URANIUM AND ANALOGOUS SUBSTANCES. II. PROPERTIES OF ION EXCHANGE. F. González García and R. Romero Díaz (Facultad de Ciencias, Seville). Anales real soc. españ. fis. y quím. (Madrid), Ser B 55, 399-406(1959) May. (In Spanish)

The basic exchange properties of calcium, magnesium, barium, lithium, sodium, and potassium uranyl phosphates and arsenates are studied. The exchange properties of the double uranyl-alkali phosphates, arsenates, and arsenate phosphates are determined. The exchange phenomenon is a general property of this group of compounds and the ions of K, Na, etc., can be completely and irreversibly replaced by the other ions by treatment with salt solutions. (auth)

20969

CONSTITUTION AND PHYSICAL-CHEMICAL PROPERTIES OF SOME DOUBLE PHOSPHATES OF URANIUM AND ANALOGOUS SUBSTANCES. III. HYDRATION. F. González García and Romero Díaz (Facultad de Ciencias, Seville). Anales real soc. españ. fis. y quím. (Madrid), Ser B 55, 407-18(1959) May. (In Spanish)

The hydration properties uranyl double phosphates and arsenates with mg, Ba, Na, Ca, Li, and K and the hydrogen-alkaline-uranyl phosphates were studied. The hydration of the various autumites depends on the nature of the exchangeable ion. Potassium uranyl phosphates contain three moles of water. Hydrogen potassium uranyl phosphates have a higher degree of hydration. The relationships between the water of hydration and the composition and structure of the compounds are discussed. (auth)

20970

CONSTITUTION AND CHEMICAL-PHYSICAL PROPERTIES OF SOME DOUBLE PHOSPHATES OF URANIUM AND ANALOGOUS SUBSTANCES. IV. DIFFERENTIAL THERMAL ANALYSIS. F. González García and Romero Díaz (Facultad de Ciencias, Seville). Anales real soc. españ. fis. y quím. (Madrid), Ser B 55, 419-28(1959) May. (In Spanish)

The differential thermal analysis curves of the alkaline uranyl and hydrogen alkaline uranyl phosphates and arsenates were studied. Conclusions on the hydration properties of the compounds and the relationship between the properties are discussed. (auth)

20971

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH NEO-THORONE. Shozo Shibata and Teiichi Matsumae (Government Industrial Research Inst., Nagoya, Japan). Bull. Chem. Soc. Japan 32, 279-82(1959) Mar.

The spectrophotometric method for the determination of microquantities of uranium with Neo-thorone was established. By this method 5 to 40 μg of uranium in 25 ml solution can be determined easily and accurately. Interference by a small amount of aluminum, zinc, lead, thorium, and iron could be avoided by using sodium ethylenediaminetetraacetate. Therefore, complete separation of iron, thorium, and aluminum is not necessary. (auth)

20972

SPECIAL SPECTROCHEMICAL TECHNIQUES. A. COPING WITH THE SPECIAL SAMPLE. Cyrus Feldman (Oak Ridge National Lab., Tenn.). Eng. Prog. Univ. Florida 12, No. 11, Bull. Ser. No. 100, 24-35(1958) Nov.

Chemical reactions occurring in the sample cavity and the effect upon volatilization of sample components are discussed. Different methods of affecting the arc temperature are given. Treatment of the sample is discussed relative to homogeneity, sensitivity, scarcity, unknown composition, and direct spectral interference. Solutions to the problem of direct spectral interference are presented. (C.J.G.)

20973

DIRECT CURRENT ARC POWER SUPPLIES FOR SPECTROCHEMICAL USE. Louis E. Owen (Goodyear Atomic Corp., Portsmouth, Ohio). Eng. Prog. Univ. Florida 12, No. 11, Bull. Ser. No. 100, 50-2(1958) Nov.

While any design considerations can be met in building source units for direct-current arc excitations, the validity of present day commercial specifications is not well established. Constant-current sources seem to have special benefits and the use of grid controlled

thyratrons as rectifying elements permits their simple construction. (auth)

20974

RADIATION-CROSS LINKING OF PLASTICIZED POLY(VINYL CHLORIDE). A. A. Miller (General Electric Co., Schenectady, N. Y.). Ind. Eng. Chem. 51, 1271-4(1959) Oct.

Polyvinyl chloride plasticized with dioctyl phthalate is cross linked by irradiation with high-energy electrons at doses of 20×10^6 r and above. The product has lower thermal stability against discoloration (dehydrochlorination) at 150°C than unirradiated material. This impairment can be prevented by adding a small amount of a tetrafunctional monomer, such as a dimethacrylate, prior to irradiation. In the presence of this additive a much lower irradiation dose (about 1×10^6 r) is required to produce cross linking and increased tensile strengths. Radiation cross linking is also effective in the presence of carbon-black filler. Although cross linking increases tensile strength of plasticized polyvinyl chloride even at room temperature, at 150°C tensile strength is increased four- or fivefold by irradiation at 1×10^6, for carbon-loadings up to 34%. (auth)

20975

SPECTROSCOPIC INVESTIGATIONS OF URANYL COMPOUNDS. A. N. Sevchenko and L. V. Volod'ko (Lenin Belorussian State Univ., Minsk). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 2, 63-71(1959) Feb. (In Russian)

Spectroscopic investigations of uranyl nitrate and uranyl acetate in complexes involving organic molecules are reported. On the basis of experimental material, it is shown that the structure of the absorption and fluorescence spectra of the uranyl ion UO_2^{++} is not independent of the physico-chemical properties of the surrounding medium and temperature. Previous attempts to interpret the fluorescence and absorption spectra of uranyl salts are reviewed in the light of data obtained from the spectroscopic investigation of uranyl salts. (auth)

20976

NEUTRON AND γ-IRRADIATION OF PHOSPHORUS TRICHLORIDE. D. W. Setser, H. C. Moser, and R. E. Hein (Kansas State Univ. of Agriculture and Applied Science, Manhattan). J. Am. Chem. Soc. 81, 4162-5 (1959) Aug.

Samples of liquid phosphorus trichloride were reactor irradiated for varying lengths of time, and the yield of P^{32}-labeled PCl_3 was measured. The percentage of the P^{32} in combination as $P^{32}Cl_3$ changed from 60 to 90% with increasing irradiation time. A radiation induced oxidation of radioactive P_2Cl_4 to form PCl_3 was postulated to explain the changing distribution of P^{32}. Two labeled products, $P^{32}OCl_3$ and $P^{32}Cl_3$, were identified in reactor irradiated $POCl_3$. The relative yield of $P^{32}OCl_3$ was also found to increase with irradiation time. (auth)

20977

POLAROGRAPHIC DETERMINATION OF INITIAL SOLUBILITY pH AND THE SOLUBILITY PRODUCT OF TRIVALENT THALLIUM HYDROXIDE. P. N. Kovalenko and T. V. Lindorf. Zhur. Neorg. Khim. 4, 1919-23(1959) Aug. (In Russian)

Polarographic and pH data were used in determining a solubility constant of 6.3×10^{-35} for $Tl(OH)_3$. (R.V.J.)

20978

THEORY OF CHROMATOGRAPHY. PART XII. CHROMATOGRAPHY OF HIGHLY RADIOACTIVE GASES. E. Glueckauf (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.69-89 of "Gas Chromatography, 1958." C. H. Desty, ed. New York, Academic Press Inc., 1958. 391p.

As a result of the temperature rise occurring in the adsorbent of the column during the passage of a highly radioactive band, the rear end of the band tends to move faster than its front. This results in a marked contraction of the bands, which finally reach a width which is independent of the original width of the feed band and of the length of the column. Both these effects are opposite to the behavior of the inactive gases in a column, and they are quantitatively discussed. One of the most useful aspects of these effects is that they afford a simple means of concentrating dilute radioactive gases into small volumes, without the need for refrigeration, provided that the total radioactive power is in the watt range. Explicit expressions are derived for the breakthrough volume, the shape of the elution curve, the peak maximum and the mean band width under steady-state conditions, as well as for the volume of column required to attain the steady state. Finally the effect is discussed of radioactive heating on the separation of the fission gases krypton and xenon. It is shown that as long as the radioactive power of the adsorbed gases is moderate, separation is slightly more efficient, due to band contraction, though the separation of the peak maxima is less. But for higher radioactive power the latter effect gains in importance, and when the ratio of power to gas flow rate approaches a value of 14 J/ml of gas, separation is no longer possible for these gases, except under specified conditions. (auth)

20979

FLUORESCENT X-RAY ANALYSIS OF HIGHLY RADIOACTIVE SAMPLES. James I. Mueller, Vincent G. Scotti, and John J. Little (Pratt and Whitney Aircraft Hot Cell Facility, Livermore, Calif.). p.157-66 of "Proceedings of the Seventh Annual Conference on Industrial Applications of X-Ray Analysis, August 13-15, 1958, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, 1959. 359p.

The use of lead shielding and pulse height discrimination as aids in reducing the background counts due to radioactive samples is described. The samples under study in this work have radioactive levels up to 40 r/hr at 17 centimeters combined $\beta + \gamma$. Data are presented to illustrate the effectiveness of shielding and pulse height discrimination individually and combined. (auth)

20980

CRYSTAL CHEMICAL STUDIES BY X-RAY FLUORESCENCE. Eugene W. White, Herbert A. McKinstry, and Thomas F. Bates (Pennsylvania State Univ., University Park). p.239-45 of "Proceedings of the Seventh Annual Conference on Industrial Application of X-Ray Analysis, August 13-15, 1958, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, 1959. 359p.

The wavelength of the characteristic x-radiation for the lighter elements is not constant but is a function of valence state and to a much lesser extent is a function of co-ordination number. Commercially available x-ray fluorescence equipment is used in detecting shifts in the characteristic radiation for aluminum, sulfur, chlorine, titanium, vanadium, and iron. The greatest shift is found in the case of chlorine where, using the NaCl analyzer, a shift of nearly 0.2° 2θ is obtained in going from the Cl^- in cholorides to the Cl^{+7} in the perchlorate. The wavelength of the $Al^{+3}K_\alpha$ varies slightly

as a function of co-ordination number. Examples are given for using these phenomena in studying minerals and other compounds. The feasibility of extending the study to both heavier and lighter elements is explored. (auth)

20981

TECHNIQUES FOR X-RAY DIFFRACTION STUDIES OF RADIOACTIVE MATERIALS. W. V. Cummings and W. J. Gruber (General Electric Co., Richland, Wash.). p.261-74 of "Proceedings of the Seventh Annual Conference on Industrial Applications of X-Ray Analysis, August 13-15, 1958, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, 1959. 359p.

Many materials, both fissionable and non-fissionable, become very radioactive when subjected to nuclear radiations. This radioactivity results in a high background level in x-ray-diffraction studies and becomes a limiting factor in an analysis of radiation damage. A description is given of special techniques that are used to minimize this background and produce optimum diffraction conditions. The radioactive intensity of irradiated x-ray specimens varies from levels that are only mildly troublesome to levels that are extremely hazardous to personnel. The diffraction methods employed at the various levels are explained. An example of the radioactive energy spectrum of a specimen is given to show the method of selecting the best operating conditions and techniques. (auth)

20982

IMPROVEMENTS IN THE VULCANISATION OF AQUEOUS DISPERSIONS OF RUBBER. Ian Kemp (to Revertex Ltd.). British Patent 816,230. July 8, 1959.

A method is described for irradiation of natural rubber to vulcanize or cause cross-linking in such a way that forming or shaping can be done after irradiation. The method consists in irradiating an aqueous dispersion of 60 to 70 wt. % latex to 10 to 40 megarads by an electron accelerator beam. The effects of various doses on elasticity are reported. The latex should be of low non-rubber content to prevent discoloration. Coagulation is prevented by concentration control, and cross-linking efficiency is satisfactory. (T.R.H.)

20983

IMPROVEMENTS IN METHODS OF CROSS-LINKING OR VULCANIZING SYNTHETIC RESINS OR RUBBERS BY MEANS OF IONIZING RADIATIONS. (to Centre National de la Recherche Scientifique). British Patent 816,791. July 22, 1959.

The improved properties resulting from irradiation of plastics, polymers, rubbers, and resins in the absence of O_2 are described. Irradiation of these materials in inert gas atmospheres or in a vacuum is suggested. (T.R.H.)

Separation Processes for Pu and U

20984 CF-59-6-119

Oak Ridge National Lab., Tenn.

THEORETICAL STUDY OF SINGLE-TRANSFER LINE CONCATENATED PULSE COLUMN SYSTEMS. H. F. Johnson. June 19, 1959. 22p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

Calculations indicate that single-transfer line concatenated pulse column systems can be operated with static pressures that are not excessive if a sufficient number of vessels are employed in the system. The required number of vessels can be attained by using a series of short columns or by using holdup pots in conjunction with a limited number of columns. General equations for calculating pressure drops and power requirements are presented. (auth)

20985 CF-59-8-88(Suppl. 1)

Oak Ridge National Lab., Tenn.

POWER REACTOR FUEL REPROCESSING: MECHANICAL PHASE. B. B. Klima. Sept. 2, 1959. 36p. Contract [W-7405-eng-26]. $9.30(ph), $3.60(mf) OTS.

An occurrence at the SRE which caused approximately 7 fuel elements to part when being pulled from the reactor complicated reprocessing, however the bulk of the elements may still be reprocessed as planned. New or reworked parts for the mechanical decladder were supplied by the fabricators for rebuilding in ORNL shops. Administrative actions dictated by budgetary considerations include reduction of UO_2 pellet order to the quantity needed this fiscal year, reduction of Mark III prototype fuel element to 12, stoppage of all work by REE Division personnel, and stoppage of all work not related to SRE fuel element reprocessing. (auth)

20986 CF-59-9-44

Oak Ridge National Lab., Tenn.

ADDITIONAL INFORMATION ON EUROCHEMIC AIR SAMPLING SYSTEM. E. M. Shank. Sept. 15, 1959. 2p. $1.80(ph), $1.80(mf) OTS.

Information relative to the proposed Eurochemic air sampling system is presented in the form of questions and answers. (auth)

20987 CF-59-9-51

Oak Ridge National Lab., Tenn.

ESTIMATE OF POTENTIAL FUEL REPROCESSING, REVISION NO. 29—PART A. J. W. Ullmann. Sept. 15, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The power and estimated reprocessing load are tabulated for existing and proposed United States and United States-built reactors of 10 kw or greater thermal power. (auth)

20988 DP-335

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

PROCESSING OF FUEL ASSEMBLIES THAT CONTAIN ZIRCONIUM. Woodfin E. Shuler. Jan. 1959. 33p. Contract AT(07-2)-1. $1.00(OTS).

Fuel elements that are clad but not alloyed with zirconium can be declad with ammonium fluoride solution and the uranium core can then be dissolved in nitric acid. If zirconium is also present as an alloying element in the core, a satisfactory approach is the combined dissolution of the fuel in a fluoride-nitric acid solution. Aluminum ion must then be added to the solution to complex the fluoride and permit recovery of uranium by Purex-type solvent extraction. Alternatively, the zirconium and the fluoride can be separated from the dissolver solution by precipitation as barium fluozirconate. (auth)

20989 DP-347

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

MANGANESE DIOXIDE PRECIPITATION IN URANIUM–ALUMINUM NITRATE SOLUTIONS. Hugh E. Henry. Feb. 1959. Decl. Sept. 4, 1959. 12p. Contract AT(07-2)-1. $3.30(ph), $2.40(mf) OTS.

Precipitation of MnO_2 in solutions of U–Al alloy effected maximum removal of fission products when the alloy solutions were acid deficient. Minimum adsorption

of U and minimum volume of centrifuged MnO_2 were obtained by precipitation in acidic solutions with vigorous agitation. (auth)

20990 DP-396

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

ELECTROLYTIC DISSOLUTION OF STAINLESS STEEL. Hugh E. Henry. July 1959. 11p. Contract AT(07-2)-1. $0.50(OTS).

Stainless steel rods and a stainless steel clad uranium rod were dissolved satisfactorily by anodic oxidation in nitric acid. Dissolving rates of stainless steel varied linearly with current density for both direct current and alternating current. Acidity, salt concentration, and temperature had very little or no effect on dissolving rates. The major gaseous product from electrolytic dissolution of stainless steel in nitric acid was nitric oxide with small amounts of carbon monoxide, nitrogen, and nitrous oxide. Samples of the off-gas contained no hydrogen. (auth)

20991 IGR-212(O/W)

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF BETA-ACTIVITY (TRANSMITTED THROUGH A TOTAL ABSORBER THICKNESS 5mg Al/sq.cm) IN PLUTONIUM PLANT SOLUTIONS AND EFFLUENTS. July 1, 1959. 6p.

A measured portion of the sample is evaporated to dryness on a stainless-steel counting tray. The β-activity of the residue is measured using standard G.M. equipment with a thin-end-window counting tube. The equipment is calibrated against standard strontium-90/yttrium-90 sources in equilibrium, prepared from solutions of known strontium-90 content and the observed activity is expressed as d.p.m. Sr^{90}/Y^{90}. (auth)

20992 NP-7827

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

EUROCHEMIC PUREX FLOWSHEETS; NO. 1, DRAWING 89a AND NO. 2 DRAWINGS 89b AND 90b. 1959. $7.80(ph), $3.30(mf) OTS.

20993 NP-7853

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

PRELIMINARY COST ESTIMATES. Technical Report No. 47, Chapter 600. O. Jenne, E. Lüscher, M. Lung, F. Marcus, and A. Redon. [195?]. 5p. $1.80(ph), $1.80(mf) OTS.

Cost estimates are presented for a 100 ton per year radiochemical processing plant and for a 350 kg U per day pilot plant. (W.L.H.)

20994 ORNL-1558

Oak Ridge National Lab., Tenn.

A DESIGN AND COST ESTIMATE STUDY OF A PUREX PLANT. H. L. Hull and H. R. Zeitlin. Mar. 31, 1954. Decl. June 29, 1959. 80p. Contract W-7405-eng-26. $13.80(ph), $4.80(mf) OTS.

The preliminary design and cost study of a hypothetical Purex plant sized to process three metric tons of irradiated natural uranium per day and designed for direct maintenance are reported. (auth)

20995

THE DETERMINATION OF URANIUM BY SQUARE WAVE POLAROGRAPHY. G. W. C. Milner and J. H. Nunn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chim. Acta 21, 266-75(1959) Sept.

Mineral acid supporting electrolytes, both in the presence and absence of tartrate ions, were examined for use in the determination of small amounts of uranium by square wave polarography. A perchloric acid-tartrate supporting electrolyte is most suitable for analytical work and was used for the determination of uranium in mineral samples. (auth)

20996

CHEMICAL REPROCESSING OF IRRADIATED NUCLEAR FUELS. S. Lawroski (Argonne National Lab., Lemont, Ill.). Compt. rend. congr. intern. chim. ind. 31e, Congr., Liège, 1958. 4p.

The chemical reprocessing of irradiated nuclear fuels is an important part of the nuclear energy industry. Various chemical processing methods have been studied in the United States with regard to their technical and economic potential for this application. To date, two types of aqueous methods have been developed and used on a production scale. The first of these was the Bismuth Phosphate Process which employed the co-precipitation principle. This process has been superseded by solvent extraction type processes which employ aqueous-organic solvent systems. At the present time all of the major plants for chemical reprocessing of spent fuel are based on solvent extraction methods. Meanwhile, two general types of non-aqueous methods are being intensively developed. They are the fluoride volatility and the pyrometallurgical methods. In order to commence and complete the fuel reprocessing cycle, it has also been necessary to develop suitable procedures for auxiliary operations such as fuel dissolution, conversion of intermediate products to finally desired forms, and handling of process wastes. (auth)

20997

TREATING BLIND RIVER URANIUM ORES BY LEACHING, ION EXCHANGE, PRECIPITATION. R. P. Ehrlich, A. G. Roach, and K. D. Hester (Rio Tinto Management Ltd., Toronto, Can.). J. Metals 11, 628-33(1959) Sept.

The Blind River ores are treated by leaching, ion exchange, and precipitation. The ore is crushed, ground, and dewatered before leaching. Excess free acid (H_2SO_4) is required for leaching, after which the leached ore and the solution are separated by means of thickeners or filters. The solution is clarified, purified, and upgraded by means of ion exchange. The uranium is precipitated by means of magnesia or caustic. All plants use column ion exchange but employ different methods of operation, including moving-bed, fixed-bed, and air-dome columns. Poisoning agents include titanium and thorium. (C.J.G.)

20998

RECOVERY OF URANIUM FROM DILUTE URANIUM-CONTAINING SOLUTIONS. George W. Bain (to Amherst Coll.). U. S. Patent 2,885,258. May 5, 1959.

A process for recovery of 85 to 95% of U from solutions containing as little as 1 ppm is described. In one example 4 l of a solution containing 4 ppm UO_2SO_4 was treated with 10 g of burned animal bone. The recovery sediment was treated with 4-liter additions of solution until the process was repeated 8 times. The final sediment contained 87.5% of the U. Halogens retard the recovery of U and their presence necessitates addition of fresh amounts of phosphate precipitant. (T.R.H.)

20999

METHOD FOR DECONTAMINATION OF REACTOR SOLUTIONS. William J. Maraman, Horace R. Baxman,

and Richard D. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,885,260. May 5, 1959.

A process for U recovery from phosphate fuel solutions is described. To fuel solution drawn from the reactor is added $Fe(NO_3)_3$ which destroys the U complex and forms ferric phosphate complex. The $UO_2(NO_3)_2$ formed is extracted into TBP–kerosene in a countercurrent column. The TBP containing $UO_2(NO_3)_2$ is further purified by an aqueous $Al(NO_3)_3$ scrub solution. The pregnant solution then goes to an H_3PO_4 stripping and kerosene washing column. The H_3PO_4–uranyl phosphate solution is separated at the bottom and boiled to remove HNO_3 then diluted to fuel solution make-up strength. (T.R.H.)

21000

SYSTEM FOR RECOVERING URANIUM FROM ITS ORES. John Clarence Karcher and Forrest J. Allen, Jr. (to Concho Petroleum Co.). U. S. Patent 2,885,270. May 5, 1959.

An apparatus and procedure for recovering U from ores is described. The crushed ore is admitted at the top of a tower and moves downward by gravity. A hot Na_2HCO_3 solution (90 to 180°F) moves upward in the tower leaching U values from the ore. A central stirrer prevents channeling and provides agitation. The uranium-laden Na_2HCO_3 solution overflows and is acidified and passed by steam jet to a gas-liquid separator to remove CO_2. From the separator the solution goes to alkalization and precipitation steps to precipitate and recover U salt. (T.R.H.)

21001

PRODUCTION OF OXYGEN-FREE AND ANHYDROUS FUSED SALT ELECTROLYTE FROM OXYGEN CONTAINING COMPOUNDS OF URANIUM. Milton J. Arnoff (to Horizons Titanium Corp.). U. S. Patent 2,887,356. May 19, 1959.

Fused U salt baths may be prepared oxygen-free from uranium compounds containing oxygen. Fused alkali metal chlorides, with or without alkaline earth chlorides are prepared and the U compound and a chlorinating agent added. The U is converted to chloride and the oxygen leaves as water or carbon dioxide. In one example a KCl–NaCl eutectic was heated to 700°C and $UO_2(NO_3)_2 \cdot 6H_2O$ was added. Water vapor and N oxides were released violently. Then HCl was added, and the mixture cooled and analyzed. Substantially all the U was converted to UCl_4. (T.R.H.)

21002

REDUCTION OF PLUTONIUM VALUES IN AN ACIDIC AQUEOUS SOLUTION WITH FORMALDEHYDE. Carl M. Olson (to U. S. Atomic Energy Commission). U. S. Patent 2,890,098. June 9, 1959.

A method is given for reducing Pu to the tetravalent state and lowering the high acidity of dissolver solutions containing U and Pu. Formaldehyde is added to the HNO_3 solution of U and Pu to effect a formaldehyde to HNO_3 molar ratio of 0.375:1 to 1.5:1. The Pu can then be removed from the solution by carrier precipitation using $BiPO_4$ or by ion exchange. (T.R.H.)

21003

PRODUCTION OF PLUTONIUM FROM PLUTONIUM FLUORIDE. Richard D. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,890,110. June 9, 1959.

Reduction of PuF_4 to metal is described. In the example given, PuF_4 is mixed with 0.3 mole I_2 per mole of Pu and Ca powder 25% in excess of that required for reduction of the Pu salt, and I_2 is added. The mixture is charged to a magnesia-lined steel bomb which is heated until reacted in a furnace. The Pu is reduced to metal and recovered as a slug after the bomb is cooled and opened. About 90% yield is obtained. (T.R.H.)

21004

DRY FLUORINE SEPARATION METHOD. Glenn T. Seaborg, John W. Gofman, and Raymond W. Stoughton (to U. S. Atomic Energy Commission). U. S. Patent 2,887,357. May 19, 1959.

Preparation and separation of U^{233} by irradiation of ThF_4 is described. During the neutron irradiation to produce Pa^{233} a fluorinating agent such as HF, F_2, or $HF + F_2$ is passed through the ThF_4 powder to produce PaF_5. The PaF_5, being more volatile, is removed as a gas and allowed to decay radioactively to U^{233} fluoride. A batch procedure in which ThO_2 or Th metal is irradiated and fluorinated is suggested. Some Pa and U fluoride volatilizes away. Then the remainder is fluorinated with F_2 to produce very volatile UF_6 which is recovered. (T.R.H.)

21005

SEPARATION BY ADSORPTION. Charles S. Lowe (to U. S. Atomic Energy Commission). U. S. Patent 2,890,932. June 16, 1959.

Separation of Pu from fission products by adsorption on hydrous aluminum silicate is described. The Pu in a HNO_3 solution is oxidized to the hexavalent state and contacted with the silicate which adsorbs fission products. (T.R.H.)

CONTROLLED THERMONUCLEAR PROCESSES

21006 AECU-4309

California. Univ., Livermore. Radiation Lab.
LITTLE PIG PLASMA EXPERIMENT. Oct. 13, 1958. 6p. (LE-267). $1.80(ph), $1.80(mf) OTS.

The Little Pig experiment was constructed to provide a stable source of plasma for use in the development of plasma diagnostic techniques. A plasma column, of rectangular or circular cross section, 7 cm in diam and 1 m in length is produced. Pulsed operation yields densities up to $\sim 8 \times 10^{13}$/cm and d-c operation yields up to $\sim 10^{13}$/cm^3 before erratic operation sets in. The electron temperatures are typically 5 to 10 ev and the percentage ionization is low. (W.D.M.)

21007 AECU-4344

Stevens Inst. of Tech., Hoboken, N. J.
INVESTIGATION OF PLASMA ACCELERATION. Quarterly Progress Report No. 3 [for] January 1, 1959–March 31, 1959. K. C. Rogers, G. Brucker, L. Ferrari, I. Mansfield, and D. Caulfield. 8p. Contract DA-36-039SC-78097. (AD-216741).

A modification to improve the dielectric strength of the transmission lines in the Stevens 100,000 joule fast capacitor bank is described. A low-jitter pulser for application to plasma switch firing is discussed. (auth)

21008 CF-55-3-103

Oak Ridge National Lab., Tenn.
ION SOURCES. John S. Luce. Mar. 18, 1955. Decl. Oct. 7, 1958. 9p. $1.80(ph), $1.80(mf) OTS.

The most troublesome hurdle in the development of successful ion sources for a magnetic mirror machine

is the ion path itself. If ions are accelerated from a source into a uniform magnetic field, they are bent by the field into a circular orbit and return to strike the source. Physical sources, virtual sources, coaxial discharges, and neutron sources are discussed. (W.D.M.)

21009 CF-57-6-115

Oak Ridge National Lab., Tenn.

COMPILATION OF VARIOUS UNDOCUMENTED CLASSIFIED MEMORANDA ON SHERWOOD PROGRAM. J. R. McNally, Jr. June 28, 1957. Decl. Oct. 7, 1958. 14p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Subjects included in the compilation are: spectroscopic studies, neutral carbon in the vacuum carbon arc, anode effects, Doppler slant effects, and Stark broadening, neutrals in the high-current carbon arc, photon breakup of H_2^+ in the high-current carbon arc, ion density in the high-current carbon arc, and recombination cross section for fast hydrogen ions and slow electrons. (W.D.M.)

21010 GA-875

General Atomic Div., General Dynamics Corp., San Diego, Calif.

TEST PARTICLES IN A PLASMA. Marshall N. Rosenbluth and Norman Rostoker. July 1959. 17p.

For presentation at the Fourth International Conference on Ionization Phenomena in Gases, held in Uppsala, Sweden, August 17-21, 1959.

A completely ionized plasma is considered. Initially, all field particles are assumed to be in thermal equilibrium except for one test particle. The test particle interacts with the field particles. The resultant reaction on the test particle consists of a frictional drag and a random force that produces acceleration and diffusion in velocity space. A systematic procedure for determining these effects was developed. The field particles are first considered in the fluid limit where $e \to 0$, $m \to 0$, $n \to \infty$ such that e/m and ne remain constant. In this limit, the field particles become polarized so that there is a cloud of charge around the test particle. The test particle is not at the electrical center, so that there is an electric field acting on it. The force consists of a contribution from Coulomb collisions that is independent of the mass of the test particle. There is also a contribution due to spontaneous emission of plasma waves. By considering a Maxwell distribution of test particles, the emission is determined. It is related to Landau's damping by Kirchoff's law. The effects that result from field-particle individuality are calculated by making an expansion in powers of e, where m and 1/n are considered to be of the same order. The fluctuation terms are of the usual form, with some additional contributions from plasma waves. There is a correction to the collisional drag force that depends on the mass of the test particle. Small corrections are obtained for the plasma-wave drag that may be interpreted as plasma-wave absorption and induced emission. The test-particle problem was solved with no magnetic field and with a constant magnetic field. (auth)

21011 NYO-7878

Princeton Univ., N. J. Project Matterhorn.

B-1 MAGNETIC MEASUREMENTS. Technical Memorandum No. 36. Alan Z. Kranz. Nov. 1956. 7p. $1.80(ph), $1.80(mf) OTS.

A number of test measurements were made on the B-1 Stellarator. Measurements were current in the confining field windings, the confining field in a straight section as a function of axial position for various areas of aperture, and the stray fields inside the plasma aperture region due to the accelerating field. Measurements are described and results are listed. (W.D.M.)

21012 SC-4324(TR)

Sandia Corp., Albuquerque, N. Mex.

AN EXPLODING WIRE AS A FUSE FOR THE LASL CAPACITOR BANK—ZEUS. Eugene C. Cnare. June 4, 1959. 32p. $1.00(OTS).

An exploding copper wire, one millimeter in diameter, 30 centimeters long, was developed as a fuse component for a Los Alamos capacitor energy source to be employed in controlled thermonuclear research studies. The fuse allows the passage of the high normal duty action (13,700 ampere-coulombs per capacitor) at a 20-second repetition rate. However, it interrupts the circuit to a shorted capacitor in 12 microseconds, thereby protecting the faulted capacitor from explosive energy consumption. The initial phase of the development included observations of various metals (copper, silver, iron, and nickel) as well as various configurations (straight wires, helixes, foils, and tubes). Direct scaling of previous small exploding wire studies at Sandia Corporation was demonstrated with scaling factors up to 700,000. (auth)

21013 UCRL-5032

California. Univ., Livermore. Lawrence Radiation Lab.

ASTRON THERMONUCLEAR REACTOR. N. C. Christofilos. 1958. 29p. Contract W-7405-eng-48. $4.80(ph), $2.70(mf) OTS.

The basic requirements for an ideal scheme to confine a plasma in adequate density and temperature to produce thermonuclear reactions on a large scale are summarized. These requirements are thought to be accomplished in the Astron Reactor by a long cylindrical layer of relativistic electrons, the E-layer. Establishment of the E-layer and initial plasma formation are discussed. Plasma stability, equilibrium, and heating are considered. The Astron experimental program is outlined. (W.D.M.)

21014 UCRL-5606

California. Univ., Livermore. Lawrence Radiation Lab.

SHIELDING AGAINST MAGNETIC RADIATION LOSS FROM A HOT PLASMA. James Paul Wesley. June 1959. 8p. Contract W-7405-eng-48. $1.80(ph), $1.80(mf) OTS.

Classical electromagnetic theory indicates that a conducting metallic shield can reduce the magnetic-radiation loss from a hot plasma undergoing D-D burn to less than 1% or two orders of magnitude. (auth)

21015

PLASMA PHYSICS AND THE PROBLEM OF CONTROLLED THERMONUCLEAR REACTIONS. VOLUME III. M. A. Leontovich, ed. and J. Turkevich, trans. ed. Translated from the Russian by J. B. Sykes. New York, Pergamon Press, 1959. 426p. $24.00.

Articles reporting on the theoretical and experimental work done in the Institute of Atomic Energy of the USSR Academy of Sciences on the problem of controlled thermonuclear reactions and plasma physics are presented. Separate abstracts are prepared of the individual papers. (J.S.R.)

21016

THERMONUCLEAR REACTIONS IN A SYSTEM WITH MAGNETIC STOPPERS AND THE PROBLEM OF DIRECT TRANSFORMATION OF THERMONUCLEAR ENERGY INTO ELECTRICAL ENERGY (PHYSICAL PRINCIPLES AND PRELIMINARY CALCULATIONS). G. I. Budker. p.1-33 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 640.

21017

SOME PROBLEMS OF THE SPATIAL STABILITY OF A RING CURRENT IN A PLASMA. G. I. Budker. p.34-44 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 641.

21018

MULTI-QUANTUM RECOMBINATION IN AN IONISED GAS. S. T. Belyaev and G. I. Budker. p.45-55 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 642.

21019

THE BOLTZMANN EQUATION FOR RAREFIED GASES IN STRONG FIELDS. S. T. Belyaev. p.56-76 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 643.

21020

KINETICS OF AN IONISED GAS IN A STRONG MAGNETIC FIELD. S. T. Belyaev. p.77-101 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 644.

21021

RADIATIVE HEAT TRANSFER FROM A DENSE HIGH-TEMPERATURE PLASMA. V. V. Babikov and V. I. Kogan. p.102-15 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 645.

21022

RECOMBINATION RADIATION FROM A HYDROGEN PLASMA. V. I. Kogan. p.116-21 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 646.

21023

ELECTROMAGNETIC WAVES IN A RELATIVISTIC PLASMA IN A MAGNETIC FIELD. B. A. Trubnikov. p.122-32 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 647.

21024

THE ELECTRON DISTRIBUTION FUNCTION IN A PLASMA IN A MAGNETIC FIELD. V. S. Kudryavtsev. p.133-40 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 648.

21025

MAGNETIC RADIATION FROM A PLASMA LAYER. B. A. Trubnikov and A. E. Bazhanova. p.141-74 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 649.

21026

THE DECAY OF AN ARBITRARY DISCONTINUITY IN A CONTINUOUS MEDIUM. T. F. Volkov. p.175-80 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 650.

21027

HIGH-FREQUENCY HEATING OF A PLASMA. L. I. Rudakov and R. Z. Sagdeev. p.181-92 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 651.

21028

THE THEORY OF RAPID PROCESSES. S. M. Osovets. p.193-212 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 652.

21029

INVESTIGATION OF A POWERFUL RING GAS DISCHARGE WHEN THERE IS AN EQUILIBRIUM ORBIT. Yu. F. Nasedkin and S. M. Osovets. p.213-30 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 653.

21030

A PLASMA RING WITH A RESISTANCE. S. M. Osovets and N. I. Shchedrin. p.231-53 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 654.

21031

THE EFFECT OF THE MAGNETIC FIELD SHAPE ON A RING GAS DISCHARGE. Yu. F. Nasedkin and E. I. Pavlov. p.254-79 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 655.

21032

INVESTIGATION OF PRESSURES IN A POWERFUL PULSED GAS DISCHARGE, USING A PIEZOELECTRIC MEASURING DEVICE. N. V. Filippov. p.280-300 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 656.

21033

THE BEHAVIOUR OF FAST ELECTRONS IN THE ELECTRON MODEL OF A TRAP WITH MAGNETIC STOPPERS. G. M. Antropov, A. V. Belyaev, and M. K. Romanovskiĭ. p.301-11 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 657.

21034

REPULSION OF A CHARGED PARTICLE FROM REGIONS WHERE THE MAGNETIC FIELD IS STRONG. O. B. Firsov. p.312-20 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 658.

21035

A QUASI-HYDRODYNAMIC DESCRIPTION OF A RAREFIED PLASMA IN A MAGNETIC FIELD. L. I. Rudakov and R. Z. Sagdeev. p.321-31 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 659.

21036

SOME PROPERTIES OF A PLASMA WITH AN ANISOTROPIC ION VELOCITY DISTRIBUTION IN A MAGNETIC FIELD. A. A. Vedenov and R. Z. Sagdeev. p.332-9 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 660.

21037

MAGNETIC TRAPS WITH A "CORRUGATED" FIELD. B. B. Kadomtsev. p.340-55 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 661.

21038

STABILISATION OF A PLASMA BY THE USE OF GUARD CONDUCTORS. S. I. Braginskiĭ and B. B. Kadomtsev. p.356-85 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 662.

21039

A PLASMA IN A "MAGNETIC GRID." O. B. Firsov. p.386-94 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 663.

21040

A STATIONARY PLASMA DENSITY DISTRIBUTION IN AN ELECTROMAGNETIC FIELD. T. F. Volkov. p.395-405 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 664.

21041

CONTAINMENT OF A PLASMA BY THE PRESSURE OF A STANDING ELECTROMAGNETIC WAVE. R. Z. Sagdeev. p.406-22 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume III."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 665.

CRITICALITY STUDIES

21042 NAA-SR-Memo-4099

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CRITICALITY CRITERIA FOR FABRICATION OF 2% ENRICHED URANIUM HOLLOW SLUGS. T. S. Moy. July 8, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

There are several points during the fabrication of uranium fuel slugs where there is a possibility of a fuel mixture becoming critical. These occur during the melting, casting, and plating of the slugs; and during the transporting and storing of sawdust, turnings, and the fabricated slugs. Several of these cases are examined and the proper volume, mass, and other characteristics that must be maintained in order to avoid criticality were determined. The problems associated with each step in the fabrication process are treated individually. (auth)

21043 ORNL-2143

Oak Ridge National Lab., Tenn.

CRITICAL MASS STUDIES. PART VIII. AQUEOUS SOLUTIONS OF U^{233}. J. K. Fox, L. W. Gilley, and E. R. Rohrer. Sept. 23, 1959. 23p. Contract W-7405-eng-26. $1.00(OTS).

A series of experiments were performed to establish the critical parameters of aqueous solutions of uranyl nitrate and uranyl fluoride in which the uranium contained 98.7% U^{233}. Solutions were made critical in both spherical and cylindrical geometries with paraffin or water as a neutron reflector and, in two instances, with no reflector. The U^{233} concentration varied from 30 to 600 g/liter. The minimum critical mass observed was 590 g of U^{233} in the solution having an $H:U^{233}$ atomic ratio of 419 occupying a 10.4-in.-diam sphere. The minimum measured volume was 3.66 liters in a 6.7-in. equilateral cylinder containing a solution with an $H:U^{233}$ atomic ratio of 39.4. Extrapolated source neutron mul-

tiplication data indicate that a 5-in.-diam cylinder can be made critical if reflected, but a 4-in.-diam cylinder would be subcritical at all moderations. It was also found that 2.02 kg of U^{233} in an unreflected 10-in. equilateral cylinder is critical with a solution having an $H:U^{233}$ atomic ratio of 154. An unreflected sphere 12.6 in. in diameter is critical with 1.14 kg of U^{233} in a solution with an $H:U^{233}$ ratio of 381. Extension of the data to geometries other than those used experimentally was made by an empirical calculation. (auth)

21044 YAEC-94

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

YANKEE CRITICAL EXPERIMENTS—MEASUREMENTS ON LATTICES OF STAINLESS STEEL CLAD SLIGHTLY ENRICHED URANIUM DIOXIDE FUEL RODS IN LIGHT WATER. P. W. Davison, S. S. Berg, W. H. Bergmann, D. F. Hanlen, B. Jennings, R. D. Leamer, and J. E. Howard. Apr. 1, 1959. 147p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.00(OTS).

To aid in the analytical design of the core for the power reactor for the Yankee Atomic Electric Company, measurements have been made of various reactor parameters in a cold clean critical assembly of design similar to the power reactor. In order to better simulate the effects of large temperature changes in the core, three core configurations were studied having water/uranium ratios of 2.19, 2.93, and 3.87. The following measurements were made: critical size, buckling and reflector savings, migration area, disadvantage factor, and cadmium ratios. The resonance escape probability and fast fission factor were measured in the 2.93 and 3.87 W/U cores. The effects on core reactivity of temperature, voids, insertion of control rods and of stainless steel were also measured. Neutron flux distributions in the core were determined in the neighborhood of control rods and through gaps and slots in the fuel configuration. Where applicable, the results of these measurements are correlated with the water/uranium ratio. (auth)

GEOLOGY AND MINERALOGY

21045

DISTRIBUTION OF RADIOACTIVITY IN SOME THIN SECTIONS OF EXTRUSIVE ROCKS FROM TRENTINO–ALTO ADIGE. Antonio Longinelli (Univ. of Pisa). Atti Soc. Toscana sci. nat. Pisa Mem. Ser. A 66, 13p.(1959).

Some thin sections of extrusive rocks from Trentino–Alto Adige, were studied by means of nuclear emulsion. The partial and total specific activities and the uranium concentrations were calculated on the basis of α activity. The results are tabulated. By comparing these results to other data regarding the average concentration of uranium in igneous rocks, it is seen that the uranium concentration of the samples studied is largely inferior to the expected one. On the basis of other studies, an interpretation of this deficit and also an hypothesis regarding the origin of the mineralizations of the Arenarie of Val Gardena are presented. (auth)

21046

RARE EARTH EPIDOTE FROM PEGMATITES OF THE MIDDLE URALS. D. A. Mineev (Inst. of Mineralogy, Geochemistry and Crystal Chemistry of Rare Elements, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 865-8(1959) Aug. 1. (In Russian)

A rare-earth yttrium-bearing epidote was discovered in granite pegmatites in Slyuda mountain in the Middle Urals. The mineral appears in pegmatite vein No. 4 as black, lenticular, columnar, or isometric structure of several millimeters of 70 cm at its largest parameter. All rare-earth epidotes of the region have crystalline shapes with poorly outlined faces. They appear as elongated, plane-prismatic crystals of monocline syngony. The crystals are zonal with luster areas followed by dull areas; the mineral is friable, the microhardness is 943.8 kg/mm^2, the specific gravity is 3.29. The rare-earth epidote is radioactive but does not luminesce, is not electroconducting or magnetic. Radiochemical analysis showed 23 times more uranium than thorium (0.14% U and 0.006% Th). The content of the epidote in percent of total rare earths is: Ce, 7.8; Dy, 13.7; Er, 30.7; Eu, 1.0; Gd, 5.8; Ho, 3.9; La, 2.4; Lu, 3.9; Nd, 2.4; Pr, 1.0; Sm, 2.0; Tb, 1.0; Tu, 4.9; and Yb, 19.5. In addition, Cu, Ga, Mg, Na, and Ni and traces of Be, Pb, Sc, and Sn were found. The age of the mineral is $\sim 1.0 \times 10^9$ years. (R.V.J.)

21047

URANIUM IN SHARON SPRINGS MEMBER OF PIERRE SHALE, SOUTH DAKOTA AND NORTHEASTERN NEBRASKA. Roy C. Kepferle. U. S. Geol. Survey Bull. 1046-R. 1959. 32p., 4 illus.

The Sharon Springs member of the Pierre shale is a lithologic unit which may be traced from exposures and from subsurface information throughout most of South Dakota and North Dakota and adjacent areas to the south. Most of the member accumulated under quiet water, probably less than 250 feet deep, and the source of the sediments was mainly to the west. The uranium is held, at least in part, by phosphatic material such as fossil fish bones and scales and in part by carbonized macerated plant remains. The vertical distribution of uranium content in the member is thought to be a function of the uranium content of the sea water following the deposition of volcanic ash now altered to bentonite. The highest uranium content in the Sharon Springs member is about 0.025%, in beds no thicker than 5 inches. The uranium content of the entire member averages about 0.0015%—higher than any average hitherto reported for black shales of post-Paleozoic age. (auth)

21048

PHOTOGEOLOGIC MAP OF THE HURRICANE CLIFFS-2 NW QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-293. J. S. Pomeroy. Washington, U. S. Geological Survey, 1959. $0.50

21049

PHOTOGEOLOGIC MAP OF THE NOTOM-1 QUADRANGLE WAYNE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-294. W. R. Hemphill. Washington, U. S. Geological Survey, 1959. $0.50.

21050

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-4 QUADRANGLE, EMERY AND CARBON COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-295. Washington, U. S. Geological Survey, 1959. $0.50.

21051

PRELIMINARY GEOLOGIC MAP OF THE HOUSE ROCK SPRING SE QUADRANGLE, COCONINO COUNTY, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-189. John D. Wells. Washington, U. S. Geological Survey, 1959. $0.50.

21052

PRELIMINARY GEOLOGIC MAP OF THE EMMETT WASH NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-215. Richard G. Petersen. Washington, U. S. Geological Survey, 1959. $0.50.

21053

PRELIMINARY GEOLOGIC MAP OF THE MOQUI SW QUADRANGLE MONTEZUMA COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-216. F. N. Houser and E. B. Ekren. Washington, U. S. Geological Survey, 1959. $0.50.

21054

PRELIMINARY GEOLOGIC MAP OF THE CORTEZ SW QUADRANGLE MONTEZUMA COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-217. E. B. Ekren and F. N. Houser. Washington, U. S. Geological Survey, 1959. $0.50.

21055

DIAGRAMMATIC RESTORED SECTION OF THE INYAN KARA GROUP, MORRISON FORMATION, AND UNKPAPA SANDSTONE ON THE WESTERN SIDE OF THE BLACK HILLS, WYOMING AND SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-218. W. J. Mapel and G. B. Gott. Washington, U. S. Geological Survey, 1959. $0.50.

21056

GEOLOGIC AND STRUCTURE CONTOUR MAP OF THE NORTHERN AND WESTERN FLANKS OF THE BLACK HILLS, WYOMING, MONTANA, AND SOUTH DAKOTA. OIL AND GAS INVESTIGATIONS MAP OM-191. W. J. Mapel, C. S. Robinson, and P. K. Theobald. Washington, U. S. Geological Survey, 1959. 2 sheets. $1.50.

21057

THE GEOCHEMISTRY OF RARE AND DISPERSED CHEMICAL ELEMENTS IN SOILS. 2nd Edition. Revised and Enlarged. A. P. Vinogradov. Translated from Russian. New York, Consultants Bureau, Inc., 1959. 212p.

This volume consists of nineteen chapters which cover the following subjects: methods of determining rare and dispersed elements in soils; some general geochemical regularities in the distribution of rare elements; soil-forming rocks and soils of the eastern European plain; boron in soils, fluorine, bromine, and iodine in soils; arsenic and selenium (tellurium) in soils; lithium, rubidium, and cesium in soils; strontium and barium in soils; rare earth metals and yttrium, titanium and zirconium (hafnium) in soils; vanadium, chromium, manganese, cobalt, and nickel in soils; copper, zinc, and cadmium in soils; lead and tin in soils, molybdenum and tungsten, radioactive elements in soils; other dispersed elements in soils; and geochemical regularities in the distribution of rare elements in soils. (W.L.H.)

21058

RADIOACTIVE BORE HOLE LOGGING (BETA RAY DETECTOR). Stanley B. Jones (to California Research Corp.). U. S. Patent 2,888,569. May 26, 1959.

A well-logging apparatus which detects beta activity is described. The device is applicable both to natural and neutron-induced beta activity. A fluid-producing horizon in a producing well can be identified by introducing a beta emitter such as Kr^{85} in an injection well and detecting beta rays of energies below 7 Mev in the well. (T.R.H.)

HEALTH AND SAFETY

21059 HW-56827(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PERSONNEL FILM BADGE NEUTRON DOSIMETER. Frank Swanberg, Jr. May 15, 1959. 16p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The neutron badge gives improved neutron dose measurement, a substantially lower acquisition cost, and savings in operating expenses relative to earlier devices employed. The measurement of dose by means of film also provides a permanent record for possible future reference. (auth)

21060 NAA-SR-Memo-4131

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ATMOSPHERIC ORGANIC CONCENTRATION IN THE OMR CRITICAL FACILITY ASSEMBLY ROOM. L. A. Mountford. July 13, 1959. 3p. $1.80(ph), $1.80(mf) OTS.

A CO_2 atmosphere is maintained above the liquid Santowax surface in the OMR critical assembly by means of a continuous CO_2 purge of about 3 cfm. This purge expells entrained organic vapors into the critical assembly room via openings in the core vessel cover. At sufficient concentrations these vapors are toxic and present an explosion hazard. It is therefore of interest to know the concentration which is present. Results obtained by the method used do not have the degree of accuracy which would be required for borderline concentrations and continuous exposures. However, the measured concentrations are far enough below the maximum permissible concentration to indicate that there is no toxicity and no explosion hazard in this case. The normal concentration in the assembly room was found to be 0.001 gm/m^3. (auth)

21061 NASA-TN-D-63

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

FIELD EXPERIMENTS ON TREATMENT OF FLUORINE SPILLS WITH WATER OR SODA ASH. R. James Rollbuhler, George R. Kinney, and Lorenz C. Leopold. Sept. 1959. 15p. $0.50(OTS).

Water and soda ash were investigated for use as deluge agents to reduce contamination from F spills. Thirty to 40% of the released F was captured by these agents. The reactions were rapid, however, no damage to the test structure was noted. Liquid F caused violent reactions. Fine water sprays were more effective reactants than were coarse. (J.R.D.)

21062 NP-7898

Ford Instrument Co., Long Island City, N. Y.

FALLOUT PREDICTOR. Quarterly Report No. 3 for January 1 through March 31, 1959. R. Bailey, W. Cannon, A. J. Cassano, M. Polan, A. Richter, and S. Smilowitz. Apr. 15, 1959. 117p. Project No. 3-99-04-112. Contract DA-36-039-SC-78185.

A functional flow chart of a program for calculating fallout is presented. Four different means of predicting the stabilized height of the cloud center are given. A simplified concept of cloud shape is described and formulas for determining the thickness and diameter of

the mushroom are presented. Equations are derived for specifying a radioactive model of the bomb cloud. Methods are presented for determining the normalized dose rate and the accumulated dosage due to fallout. A brief review of wind input sources is followed by a discussion of vertical air motion forecasting methods and associated shower activity. The influence of topography on wind fields is discussed. Methods of silent area and single station forecasting are described. A method of dividing the bomb cloud into small pieces and operating on these pieces to determine their final ground positions is presented. The application of radar support information to rainout is discussed. A method is suggested for including the wind deviation in the total fallout prediction. The structure of a typical digital computation system is described and a preliminary estimate is made of the storage requirements of the predictor. (auth)

21063 RM-2409(RAND)

RAND Corp., Santa Monica, Calif.

NOTE ON THE STRONTIUM-90 FALLOUT. A. L. Latter and M. S. Plesset. July 7, 1959. 7p.

A revision is reported of an estimate made previously of the mean residence time of Sr-90 in the stratosphere from data recently made available by Libby. It is assumed that stratospheric fallout is uniformly distributed over the earth's surface and that the tropospheric fallout is confined about the latitude of the explosion. The mean stratospheric residence time is found to be between 6 and $7\frac{1}{2}$ years. The previous estimate made in RM-1956, Note on the Sr-90 Hazard, determined this value to be between 4 and 6 years. (auth)

21064 USNRDL-TR-347

Naval Radiological Defense Lab., San Francisco.

ATMOSPHERIC REACTIONS OF SLURRY DROPLET FALLOUT. N. H. Farlow. Apr. 2, 1959. 35p.

The evaporation, growth, and physical properties of slurry fallout particles descending through the atmosphere are quantitatively examined by application of established cloud-physics equations. An arithmetic system of analysis is proposed and applied to radioactive slurry fallout particles collected at Operation REDWING. Reasonable agreement between observed and calculated particle properties supports the validity of applying this method to other meteorological situations where volatile droplet fallout may occur. (auth)

21065 Y-A2-195

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

A STUDY OF Y-12 AREA MONITORING FOR CRITICAL BURSTS. J. W. Wachter. Dec. 3, 1956. Decl. June 24, 1959. 24p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

The problems of production area monitoring for nuclear accidents were studied. The characteristics of a criticality burst including estimates of the resulting neutron and gamma radiation are discussed. Recommendations as to the criteria which might be applied in the design of a suitable monitor are listed. It is concluded that ion chambers, possibly containing dose-integrating foils, are the most suitable of existing radiation detectors for area monitoring at Y-12. (auth)

21066 AEC-tr-3669

SAFETY CONTROL MEASURES DURING WORK WITH A GAMMA-RAY DEFECTOSCOPE. Translated from Zdravookhranenie Rossiiskoi Federatsii, No. 3, 34-5 (1958). 4p. $1.80(ph), $1.80(mf) JCL or LC.

Techniques to be used with a gamma defectoscope inspecting pipe joint welds in the field are described. (T.R.H.)

21067 AEC-tr-3671

HOW TO PROTECT ONESELF FROM THE ACTION OF ATOMIC WEAPONS. CHAPTER IV. SHELTERS AND PERSONAL MEANS OF PROTECTION. Wladyslaw Panufnik. Translated from Chapter IV, p.99-116 of Jak Chronic sie Przed Dzialaniez Broni'atomowej. 13p. $3.30(ph), $2.40(mf) JCL or LC.

Characteristics of safe shelters for the civilian population in the event of radiological warfare are discussed. It is assumed that in case of an atomic war everyone would carry a container with a gas mask, a little food and water, and personal clothing, and that women and children would always have available a long, white, protective blanket to cover the body from head to toe. When on the street everyone would learn to locate a shelter nearby. Shelters for large buildings would have two entrances and an exit located away from the walls of the building. Doors should be airtight double doors. The shelter would be resistant to shock waves and to debris from the upper floors. It would be hermetically tight against the penetration of the pressure of shock waves. A ventilation system would provide filtered ventilation. The shelters should be stocked with first aid equipment and provisions for a short stay. Other types of shelters described include a shelter for 150 people to be built in an open space and having a vault protruding only slightly above ground, a wood-soil shelter to accommodate 30 to 40 people, a ditch dug in the ground and fitted with walls and a roof, and home shelters in the corner of a basement. The behavior of people during an emergency such as an atomic explosion, individual means of protection against radioactive materials, and the possibility of the contamination of food and water supplies are discussed. (C.H.)

21068 AEC-tr-3782

PROBLEMS AND PROGRESS OF IRRADIATION PROTECTION ACCORDING TO THE FILM DENSITY METHOD. (Probleme und Fortschritte der Strahlenschutzüberwachung nach der Filmschwarzungsmethode.) Felix Wachsmann and Wolfgang Schubert. Translated for Oak Ridge National Lab. from Rontgen Bl. 12, No. 4, 1-8(1959). 19p. (Includes original, 8p.). $3.30(ph), $2.40(mf) JCL.

Irradiation protection and control are discussed with emphasis on the film method. Civil laws related to irradiation protection are reviewed. Radiation identification is examined and various detection methods are discussed. Records on individuals are described, and assistance available in radiation problems is noted. (J.R.D.)

21069

GROUND-WATER STUDIES IN NEW MEXICO USING TRITIUM AS A TRACER, II. Haro von Buttlar (New Mexico Inst. of Mining and Tech., Socorro). J. Geophys. Research 64, 1031-8(1959) Aug.

Monitoring of tritium concentrations of rain and ground-water in New Mexico was continued. A third peak in the rain water was found in the summer of 1957. By comparing the tritium content of ground-water with that of rain water, hydrologic quantities such as age and velocity of flow of the ground water could be determined. The tritium method shows considerable promise as a hydrologic tool. (auth)

21070

PURIFICATION OF AIR FROM RADIOACTIVE AEROSOLS. Med. Rabotnik, No. 96, 3(1958) Dec. 2.

Methods which use filtration materials made from crumbled rubber, porous air-permeable rubber, foam plastic, and filtration cardboard to trap radioactive aerosols are discussed. Filters saturated with radioactive substances caught from air are burned in special furnaces and the ashes buried. Air purification in some methods is 99% efficient. (C.J.G.)

21071

FEDERAL-STATE RELATIONSHIPS IN THE ATOMIC ENERGY FIELD. HEARINGS BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FEDERAL-STATE RELATIONSHIPS IN THE ATOMIC ENERGY FIELD, MAY 19, 20, 21, 22, AND AUGUST 26, 1959. Washington D. C., Joint Committee on Atomic Energy, 1959. 509p. (GPO).

Federal-state relationships are discussed relative to radiation protection standards, medical use of radioisotopes, transportation of nuclear materials, and waste disposal processes involving reactors and the uranium mining and milling industry. Legislation regarding the prevention of major disasters in mines is given. (C.T.G.)

INSTRUMENTS

21072 AD-69654

Signal Corps Engineering Labs., Fort Monmouth, N. J.

THE EIGHTH ANNUAL BATTERY RESEARCH AND DEVELOPMENT CONFERENCE MAY 25-26, 1954. 45p.

Nineteen papers were presented at the conference. The papers covered the subjects of lead acid batteries, N–Cd batteries, battery industrial preparedness program, Zn–AgO system, activating devices, water activated systems, Ni–Cd system, mercuric oxide system, chlorine depolarized system, nuclear batteries, solid electrolyte batteries, conductive plastic cell, new electrochemical systems, and battery separator materials. (W.L.H.)

21073 AERE-R-2961

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A GENERAL PURPOSE LOW VOLTAGE POWER UNIT. A. Lewis. June 1959. 13p. $0.35(BIS).

A design for a general purpose power unit supplying stabilized voltages for use with transistor equipment is described. (auth)

21074 ARF-1152-2

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN IMPROVED NUCLEAR DENSITY GAUGE. Period covered: July 1 to August 1, 1959. G. M. Burgwald. Aug. 7, 1959. 4p. Contract AT(11-1)-745. $1.80(ph), $1.80(mf) OTS.

Development of a nuclear density gage is reported. A scintillation detector is used to alternately view the radiation transmitted through a sample and through a calibrated wedge. In simple cases the two radiation beams are mechanically chopped at 60 cycles, and the difference in intensity activates a servosystem which repositions the wedge until balance is achieved. Development of a lead chopper for use with Tm^{170} is reported. The commutating system described previously was completed and is being tested. Research has begun on the use of mechanical energy discrimination in gaging. (J.R.D.)

21075 CF-55-11-160

Oak Ridge National Lab., Tenn.

MOLECULAR ION SOURCE. J. S. Luce. Nov. 30, 1955. 6p. Contract [W-7405-eng-26. $1.80(ph), $1.80(mf) OTS.

A trapping mechanism utilizing dissociation and ionization of molecular ions is described. The effect of electron energy, gas pressure, and wall material on arc behavior is discussed. Measurements of the beams emerging from a grid-type ion source are given. (auth)

21076 CREL-780

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSISTORIZED COUNTING SYSTEMS. 14. A TIME TO PULSE HEIGHT CONVERTER FOR THE MEASUREMENT OF SHORT HALF-LIVES. T. K. Alexander. July 1959. 20p. (AECL-855). $0.50(AECL).

A time-to-pulse-height converter was designed to measure short half lives of artificially produced radioactive isotopes in conjunction with an irradiation facility and a kicksorter. The unit generates rectangular pulses to control the irradiation period, and the signal pulses arriving from a detector in the interval between irradiation pulses are modulated in amplitude by a linear ramp function. The output height of a signal pulse is then proportional to the elapsed time from the end of the irradiation pulse. The time base ranges from 10^4 to 0.1 c/s in decade steps and the irradiation pulse width is variable up to 10% of the repetition period. (auth)

21077 CREL-829

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSISTORIZED PULSE AMPLIFIERS. I. MEASUREMENT OF THE HIGH-FREQUENCY PARAMETERS OF TRANSISTORS. J. B. S. Waugh and R. W. Nicholson. July 1959. 40p. (AECL-859). $1.00(AECL).

The techniques and equipment employed to measure the small signal short circuit admittance parameters of drift transistors over the range 1 to 30 Mc/s are described. The equipment and methods used are suitable for measurements on other types of high-frequency transistors over the same frequency range. Topics discussed include the selection of the most suitable set of parameters to measure, the measuring equipment, and biassing circuits. The results obtained for six type 2N247 Drift Transistors are presented. Appendices deal with some subsidiary measurements on the high-frequency behavior of coupling capacitors and the effects of such capacitors on the measured values of complex admittances. (auth)

21078 HW-42636(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CONTINUOUS ELECTROCHEMICAL DETERMINATION OF OXYGEN IN GASES. K. Koyama. Mar. 28, 1956. Decl. with deletions Apr. 6, 1959. 14p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Details of a cell adapted from the Hersch design are presented. Associated equipment to automatically record low concentrations of oxygen in carbon dioxide, carbon monoxide, nitrogen, hydrogen, and the inert gases is also described. Results of experimental analyses are included. (J.R.D.)

21079 HW-59834

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REMOTE AREA SCINTILLATION MONITORING SYSTEM. W. G. Spear. Apr. 21, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

Several possible variations of remote area scintillation monitoring systems are briefly discussed along with probable cost estimates. The remote area scintillation monitoring system detector circuits described were tested for temperatures from −20 to +140°F with satisfactory results. By proper selection of phototube high voltage and/or crystal detector, the described systems can have a readable sensitivity of from ~0.3 mr/hr up to 10 r/hr as desired for the application. Alarming devices, of any voltage-operated type, may be included at both the local or remote location and also at the central station. (W.L.H.)

21080 HW-60678

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN IMPROVED RECORDING MULTICOLOR PYROMETER. B. B. Brenden and H. W. Newkirk. May 27, 1959. 18p. Contract W-31-109-Eng-52. $0.75(OTS).

The construction, calibration, and operation of a multicolor pyrometer are reported. The instrument employs three cadmium sulfide cells as radiation detectors. Interference filters mounted in front of each cell indicate the amount of energy radiated in three different wavelength bands. The output of each cell is printed on a strip-chart recorder in less than three seconds. Analyses of the recorded cell outputs permit a determination of three two-color temperatures. Data obtained by calibrating the instrument during a four-hour period show that the average value of the three temperatures differs from the true temperature by ±40°K. Better reproducibility was achieved by calibrating at more frequent intervals. (auth)

21081 IGIS-72(RD/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

BIBLIOGRAPHY ON PUMPS FOR CORROSIVE LIQUORS. E. McCoy, comp. June 10, 1959. 17p. $0.25(BIS).

References to papers, unclassified reports, and patents from Engineering Index, 1950 to 1957, Chemical Abstracts, 1937 to 1956, and Nuclear Science Abstracts, 1948 to 1958, on pumps for corrosive liquors are presented. (J.E.D.)

21082 KAPL-M-PLE-2

Knolls Atomic Power Lab., Schenectady, N. Y.

ELEMENTS OF FUEL CONTAMINATION CONTROL BY ALPHA COUNTING. P. L. Eisenacher. Aug. 10, 1959. 15p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Any fissionable material on the surface or within fission particle range of the surface of reactor fuel and core material can contaminate the coolant with fission products. An attempt is made to show how to find alpha particle emission rates when concentrations are given in ppm, to point out special counter requirements imposed by the counting rates involved, and to outline certain tests to ascertain that counters are operating properly. It is shown that one microgram of U^{235} is indicated by not less than 2.68 alpha disintegrations per second regardless of the degree of enrichment. When distributed uniformly through Zircaloy-2, 1 part per million of natural U is indicated by 0.336 alpha particles per minute emerging from a surface of 100 cm^2 area. Elementary statistical equations and constants are given to show how to report counting data and to test counters for reliability. (W.L.H.)

21083 NAA-SR-2983

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A THROUGH-ROOF HOIST FOR REMOTE MAINTENANCE OF HOT-CELL LIGHTS IN THE PROCESSING REFABRICATION EXPERIMENT. G. Gustovich. Sept. 15, 1959. 70p. Contract AT-11-1-GEN-8. $1.75(OTS).

As part of the Processing Refabrication Experiment (PRE) a facility was designed to demonstrate the remote processing of short-cooled nuclear fuels which had been irradiated to power reactor levels. The Luminaire assembly, which was developed and operated as part of the PRE to meet these needs, consists of a 3-kw lamp located along the longitudinal axis of the parabolic surface of a reflector-type heat exchanger. The insulated electrical and coolant lines pass through a precisely surfaced through-roof conduit to the utility supply outside the cell. The through-roof conduit is tubular, filled with magnesia and steel shot shielding materials, and sealed to the installation housing by a primary in-cell seal and secondary out-of-cell seals. The conduit is supported by both an out-of-cell lock nut which also serves to compress the in-cell gasket-seal during lamp operations and extension rods suspended from an out-of-cell hoist during luminaire maintenance operation. The through-roof conduit, extension rods, and hoist perform as a rigid-arm crane to lower luminaire assemblies for in-cell maintenance. With the luminaire assembly replaced by a special hook attachment, items such as top-riding hoists, manipulators, and associated bridges could be lowered in the cell for maintenance. The technical considerations affecting design and an evaluation of operational and maintenance procedures are presented. (auth)

21084 NAA-SR-Memo-4144

Atomics International Div., North American Aviation Inc., Canoga Park, Calif.

MRII DRIVER AND DETECTOR CIRCUIT FOR PRECISION SODIUM LEVEL PROBE. J. Campbell. July 21, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

A circuit was designed which provides a satisfactory display on a 2" center zero meter as the dipstick probe traverses a thimble in a sodium vessel. The unit is self contained and all components are mounted in a 10 × 8 × 6" cabinet. Front panel adjustments are held to a minimum. Gain and sensitivity adjustments are accessible to the operator through the rear of the cabinet. These controls compensate for differences in electromagnetic characteristics between probes.

21085 NRL-5326

Naval Research Lab., Washington, D. C.

THERMOLUMINESCENT DOSIMETER. J. H. Schulman, R. J. Ginther, R. D. Kirk, and H. S. Goulart. Apr. 27, 1959. Project NR 523-000.

The use of thermoluminescence for radiation dosimetry is described and the limitations of previously employed thermoluminescent dosimeters are pointed out. It is shown that a special manganese-activated calcium fluoride phosphor permits detection of x-ray and gamma-ray doses in the milliroentgen range and offers promise as a replacement for the photographic film badge in health physics applications. The dosimeter consists of a coating of the phosphor bonded to a small metal sup-

porting disk by conventional enameling techniques. It is read by inserting it into a small preheated oven, which causes the dosimeter to luminesce with an intensity proportional to the radiation dose. The thermoluminescence is measured by a phototube and recorded. (auth)

21086 SC-4336(TR)
Oklahoma State Univ., Stillwater. School of Electrical Engineering.
INVESTIGATION OF DYNAMIC CHARACTERISTICS OF RELAYS. Interim Report [for] January 26 to March 31, 1959. 49p. For Sandia Corp. $1.25(OTS).

Armature overtravel in relays was investigated. Oscillograms are used to illustrate how the time of overtravel may be found. The time and amount of contact overtravel are determined by the relay design and may be indicated on an oscillogram. The oscillograms also are used to show that variations in the transient coil current trace can be used to identify certain conditions in the relay operation and to show other factors which may be involved in transient coil current and voltage across the relay contacts. This was repeated for a relay which has a microswitch inside the sealed enclosure. Oscillograms were also obtained on a relay where the air gap was held constant and the spring tension changed. This was repeated for several air gaps. The oscillograms were of transient coil current vs. time. Two curve sheets were plotted to show how these adjustments may be used to secure different operating times. The actuation time of several relays is studied. A relay with NO contacts, a relay with an NC contact, and a relay with SPDT or transfer contacts are shown. The actuation time of an NC contact on one relay is not necessarily shorter than the actuation time of such a contact on another relay. It is suggested that the actuation time could be studied to acquire additional information on relay performance. (auth)

21087 SCTM-164-59-52
Sandia Corp., Albuquerque, N. Mex.
TRANSISTORIZED AUDIO AMPLIFIER PA-2W-1A. Melvin H. Brock. May 4, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

A transistorized audio amplifier which will amplify communications from a 500-ohm, 0-dbm, balanced transmission line to a 2-watt level, suitable for driving loudspeakers is described. (auth)

21088 SCTM-165-59(52)
Sandia Corp., Albuquerque, N. Mex.
POWER SUPPLY. Melvin H. Brock. May 6, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

A power supply which employs transistors for voltage regulation is described. It can provide 28 volts d-c at 300 ma from 110v a-c mains. (auth)

21089 AEC-tr-3828
HIGH RESOLUTION β-SPECTROMETER OF A NEW DESIGN. H. Wild and O. Huber. Translated by Lydia Venters (Argonne National Lab.) from Helv. Phys. Acta 30, 3-32(1957). 34p. $6.30(ph), $3.00(mf) JCL.

The design of a single unit β spectrometer with a high luminosity limit, and resolution limits of < 0.1 to about 2.5% is described. The instrument allows for simultaneous measurement of close electron energy lines by the use of film, and has a range energy of 10 kev with an energy of 2.5 Mev at constant focusing conditions. (J.R.D.)

21090
DESIGN AND MATERIALS FOR REDUCED PUMP CORROSION. Jack E. Piccardo (Dorr-Oliver, Inc.). Corrosion 15, 473t-6t(1959) Sept.

Of the pumps used in the chemical and allied industries, about 90% are of the centrifugal and diaphragm types. These pumps are required to handle corrosive liquids under conditions of high pressure and high temperature, expensive or hazardous liquids where leakage to atmosphere cannot be tolerated, liquids with solids in suspension, often of an abrasive nature, creating both corrosion and abrasion problems, and extremely corrosive liquids which may be radioactive. Diaphragm type pumps have certain advantages over centrifugal pumps for severe chemical applications because there is no shaft sealing problem solids in suspension can be handled at relatively low velocities and a high degree of corrosion resistance can be obtained by the use of high alloy steels for the pump body and synthetic materials for diaphragms. Packingless pumps include the so-called canned-motor centrifugal pump in which the pump impeller is mounted on the same shaft as the rotor. Both the rotor and the stator are sealed from the fluid by corrosion resistant cans or shields and the rotor moves in the liquid being pumped. The rotor-impeller shaft is supported on sleeve type bearings submerged in the liquid pumped. Canned-motor pumps usually cannot be applied where the liquid contains solids because of close clearances and possibility of damage to bearings by abrasion. Designs giving longer service life in the conventional centrifugal pump usually include the following: improved sealing devices where the pump shaft passes through the casing, new alloys or metals for the wetted end to provide a better corrosion resistance, and improved elastomers, plastics, and ceramics which permit lining entire pumps for a high degree of corrosion resistance. Improved shaft seals are discussed along with a study of new materials available for pump parts, and linings for pumps commonly used in chemical pumping service. (auth)

21091
CORRECTION FACTORS FOR THE ABSOLUTE DOSIMETRY OF FLAT β-SOURCES WITH THE AID OF GEIGER-MUELLER COUNTERS. Jirina Matouskova (Inst. for Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 219-32 (1959). (Translated from Referat. Zhur. Fiz. No. 2, 1959, Abstract No. 2651.)

The influence of self absorption and of the geometry when operating counters with flat sources is examined. An expression is derived for the self-absorption factor in a homogeneous flat source, and the influence of the window thickness of an end window Geiger-Mueller counter on the geometric distribution of the radiation is considered. The author also establishes relationships that simplify the calculations of the radiation. (auth)

21092
SOME REMARKS WITH RESPECT TO DIFFERENTIAL SYSTEMS OF RAPID COINCIDENCES. M. Maitrot (Inst. de Physique Nucléaire, Lyon). J. phys. radium 20, 717-18(1959) July. (In French)

The differential system of rapid coincidence was applied to the output of two scintillation probes using liquid scintillators, to determine if the differential method could improve the techniques of rapid coincidences. The results showed no improvement over conventional techniques. (J.S.R.)

21093
INFLUENCE OF TEMPERATURE ON PHOTOMULTI-

PLIERS. A. Coche and G. Laustriat (Faculté des Sciences, Strasbourg). J. phys. radium 20, 719-20 (1959) July. (In French)

The effects of temperature on photomultiplier tubes were studied at 20 and −30°C by a measurement of the gain of the tube. The result showed that the temperature has practically no effect on the cathode current when the wave length of the illuminating light was less than 5000 A. Above this value there is a decrease of the current with temperature. The anode current shows the same effects. (J.S.R.)

21094

MEASUREMENT OF THE FLUX OF THERMAL NEUTRONS BY THE ACTIVATION METHOD. Andras Adam and Istvan Lovas. Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 521-34(1957). (Translated from Referat. Zhur. Fiz. No. 2, 1958, Abstract No. 2643.)

The requirements that must be met by radioactive indicators used for the measurement of neutron flux are listed. The relationship between the neutron flux and the activity, resulting from neutron capture, is considered. The principle of measurement of the absolute activity by the coincidence method is described in general outline. Also described is the construction of the measuring apparatus, consisting of scintillation and Geiger-Mueller counters. The problems of results estimate and measurement errors are discussed. (auth)

21095

FATIGUE OF CATHODES OF SELF-QUENCHING GEIGER-MUELLER. Otto Orient. Magyar Tudomanyos Akad. Központi Fiz. Kutató, Intézetének Közlemenyei 5, 577-81, IV-V(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1959, Abstract No. 2622.)

An investigation was made of the work function and of the operational data (length and slope of the plateau) with copper and nickel cathode after prolonged operation (fatigue). The results of the investigations have shown that the gas mixture and the cathode exhibit fatigue in prolonged operation. The work function of the tube increases first strongly with increasing of fatigue, and then more weakly. As a result of the fatigue, the work function influences the parameters of the counter such as the length and slope of the plateau. (auth)

21096

AUTOMATIC RECORDING SCINTILLATION γ-SPECTROMETER. Dezso Kiss, Lajos Matus, and Zoltan Zamori. Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 589-98, V(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1959, Abstract No. 2627.)

A single crystal automatic recording scintillation γ spectrometer was constructed. The resolving power of the instrument (for the 661-kev line) is 9.5%, the non-linearity is less than 1% up to 4.4 Mev, and the stability is satisfactory. The entire spectrum can be photographed within five minutes. A modification of the instrument is proposed, which would permit an evaluation of the line intensity from the height of the photo line. The corresponding calculations are included. (auth)

21097

PNEUMATIC TUBES SPEED ACTIVATION ANALYSIS. W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Nucleonics 17, No. 9, 86-9(1959) Sept.

Pneumatic-tube facilities which can get samples from the reactor to the counter in seconds enable the use of nuclides with half lives of minutes and even seconds. Analyses can be completed in half an hour. Operating by vacuum minimizes the possibility of contaminating the receiving station with radioactive dust from the tubes. (C.J.G.)

21098

PULSE-SHAPE DISCRIMINATION IDENTIFIES PARTICLE TYPES. R. B. Owen (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nucleonics 17, No. 9, 92-5(1959) Sept.

Pulse-shape discrimination used with scintillation counters is used to determine the type of particle causing a scintillation. Several types of circuits used as pulse-shaped discriminators are described. Applications and discrimination methods for various circuits are described. (C.J.G.)

21099

KANDIAH DISCRIMINATOR PERMITS SIMPLIFIED MONITOR CIRCUIT. M. H. Goosey (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucleonics 17, No. 9, 104(1959) Sept.

The Kandiah discriminator, sensitive enough to operate directly from the output of a photomultiplier without the use of an amplifier, enabled construction of a simplified radiation monitor. The discriminator has a stability of 1% at a 10 mv signal level and a linearity of 3%. (C.J.G.)

21100

CAB-O-SIL SUSPENSIONS FOR LIQUID-SCINTILLATION COUNTING. D. G. Ott, C. R. Richmond, T. T. Trujillo, and H. Foreman (Los Alamos Scientific Lab., N. Mex.). Nucleonics 17, No. 9, 106, 108(1959) Sept.

A new thixotropic suspending agent for liquid-scintillation counting that requires no heating or mechanical homogenization and does not decrease counting efficiency, even for low-energy tritium betas, is reported. (C.J.G.)

21101

COMMERCIAL MICRODOSIMETER USES GLASS FLUORESCENCE. Nucleonics 17, No. 9, 128-9(1959) Sept.

Small bits of glass rod and a unique fluorescence reader form a commerical dosimetry system designed for field mapping and therapy. Accuracy of 5% or better is available at 10 to 10,000 rads, and the system is capable of detecting 1 rad. (auth)

21102

NEUTRON SPECTROMETER WITH A "PULSED BEAM" CYCLOTRON. K. G. Ignat'ev, I. V. Kirpichnikov, and S. I. Sukhoruchkin. Pribory i Tekh. Eksp. No. 4, 25-31(1959) July-Aug. (In Russian)

A 256 channel neutron selector for cyclotron use is described. High density neutron pulses of ~0.1 μsec are achieved with the device. The width of the selector channel varies from 0.25 to 32 μsec. All intermittent relations in the pulse retarding analyzer are kept constant with a high degree of accuracy. With a 15-m distance between the neutron moderator and detector, the selector has a resolving power of 0.024 μsec/m. (R.V.J.)

21103

CONVERSION OF AMPLITUDE DISTRIBUTIONS INTO ENERGY SPECTRA. Yu. A. Kazanskii. Pribory i Tekh. Eksp. No. 4, 32-4(1959) July-Aug. (In Russian)

The pulse amplitude spectrum and the efficiency of a single crystal scintillation γ spectrometer with a CsI(Tl) crystal were studied. The data were plotted as a numerical matrix which was used for a sequence of subtractions by which pulse amplitude distributions were converted into energy spectra. The amplitude distribution from Au^{198} (0.411 Mev), Ce^{141} (0.145 Mev), Cr^{51} (0.32 Mev), Cs^{137} (0.411 Mev), K^{42} (1.51 Mev), Zn^{65} (1.12 Mev), and Zr^{95} (0.76 Mev) are analyzed. (R.V.J.)

21104

XENON BUBBLE CHAMBER. E. V. Kuznetsov and I. Ya. Timoshin. Pribory i Tekh. Ekspt. No. 4, 40-4 (1959) July-Aug. (In Russian)

Descriptions are given of a xenon bubble chamber with a working volume of $20 \times 11 \times 10$ cm^3. (tr-auth)

21105

METHOD OF SECOND ORDER DIFFERENCES FOR MEASURING MULTIPLE SCATTERING IN PROPANE BUBBLE CHAMBER. I. I. Pershin, V. V. Barmin, V. P. Kanavets, and B. V. Morozov. Pribory i Tekh. Ekspt. No. 4, 44-9(1959) July-Aug. (In Russian)

The method of second order differences was used for measuring the partial mass and electron energy in multiple scattering in a propane bubble chamber. Scattering constant magnitudes for propane were derived using Williams and Molier theories, and the experimental data are developed by measuring μ mesons and positrons. Special conditions arising in measuring multiple scattering are discussed. (tr-auth)

21106

CONVECTION CHAMBER, A NEW APPARATUS FOR OBSERVATION OF CHARGED PARTICLE TRACKS. V. K. Lyapidevskii (Moscow Inst. of Engineering Physics). Pribory i Tekh. Ekspt. No. 4, 49-53(1959) July-Aug. (In Russian)

A convection chamber design, similar to a diffusion chamber scheme, is described. In contrast to the latter, at the bottom of the convection chamber temperature varies up to 80°C. Graphs of the temperature distribution, partial pressures, and saturation volume are plotted. Descriptions are presented of a chamber for measuring the activity of solids, liquids, and gases. Pictures are given of charged particle tracks in the chamber. (tr-auth)

21107

ON THE SUPERCOMPRESSION OF HIGH-SPEED WILSON CHAMBER. A. P. Andreev (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 4, 53-5(1959) July-Aug. (In Russian)

An expression was derived for the required minimum adiabatic supercompression ϵ_C, which allows complete evaporation of non-charged drops appearing before the compression. A numerical evaluation was made for a chamber operating with pure ethyl alcohol vapor under 1 atm compression in air and 100 atm in hydrogen. (tr-auth)

21108

A SMALL-DIMENSION IONIZATION CHAMBER WITH He^3 UNDER 4 atm COMPRESSION. A. I. Abramov. Pribory i Tekh. Ekspt. No. 4, 56-7(1959) July-Aug. (In Russian)

Descriptions are given of a spherical ionization chamber designed for spectrometric recording of fast neutrons. The chamber mixture is composed of 50% He^3 and 50% Ar. The resolving power of the chamber is ± 30 kev for slow neutrons and ± 80 kev for neutrons with energy of 600 kev. (tr-auth)

21109

AN INSTALLATION FOR SEMI-AUTOMATIC PHOTOGRAPHIC PROCESSING OF LARGE EMULSION CHAMBERS. D. M. Samoilovich, V. A. Smirnitskiĭ, S. A. Sukhov, V. D. Ryabov, and A. V. Rulev. Pribory i Tekh. Ekspt. No. 4, 58-62(1959) July-Aug. (In Russian)

The process and apparatus design for semi-automatically handling layers of large emulsion chambers are described. The operating area of the developing apparatus is 2 m^2 and 10 m^2 of the fixer. The development of a 4 l chamber with 500 layers, 400-μ thick was accomplished in 2 days, with non-glued layers and in 3 days with glued layers. The fixing and washing of non-glued layers takes 40 to 50 hours and glued 70 to 80 hours. Consequently, it takes 4 to 6 days to complete the processing of a 4 l chamber. (tr-auth)

21110

PLASTMASS SCINTILLATORS CONTAINING 1,2-Di (1-NAPHTHYL)-ETHYLENE. L. L. Nagornaya and A. P. Kilimov (Khar'kov Section of the All-Union Scientific Research Inst. of Chemical Reagents). Pribory i Tekh. Ekspt. No. 4, 63-6(1959) July-Aug. (In Russian)

Studies were made of the luminescence and scintillation properties of 1,2-di(1-naphthyl)ethylene in polysterole. Plastmass scintillators, with 1,2-di(1-naphthyl)ethylene the basic admixtures or as spectrum displacers, were prepared by high temperature polymerization. With γ excitation the luminosity approaches 125 to 130% and 140 to 145% of the luminosity of 2% p-terphenyl in polystyrene. (tr-auth)

21111

INVESTIGATIONS OF THE ULTRAVIOLET RADIATION CONVERTERS IN GAS SCINTILLATION COUNTER. A. N. Protopopov, Yu. A. Selitskiĭ, and S. M. Solov'ev (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 4, 66-9(1959) July-Aug. (In Russian)

Tests were made of gas scintillation counter performance with various converters of xenon ultraviolet radiation (tetraphenyl, tetraphenylbutadien, sodium salicylide, and POPOP). The relative duration of the converter fluorescence was determined. The results of recordings made for fragments from U^{235} fission by 15-Mev neutrons are included. (tr-auth)

21112

SCINTILLATION CONVERSION EFFICIENCY OF NaI(Tl) CRYSTALS. I. I. Lomonosov, A. N. Pisarevskiĭ, and L. D. Soshin (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 4, 70-1(1959) July-Aug. (In Russian)

Measurements were made of the $b = b(E_\gamma)$ and the physical scintillation conversion efficiency of NaI(Tl) crystals. The resolving power of crystals was measured by a 128-channel analyzer with a photomultiplier $\Sigma = 16\%$ (with $\lambda = 4047$A). For the 660 kev Cs^{137} γ line the $\Delta_S = 7.5$ to 10%, $\Delta_P = 4.4$ to 5.2%. The general relation of $b^2 = f(1/E_\gamma) = \Delta_C^2$ was, with small variations, the same for all crystals. Graphs of the conversion efficiency K determined for given (E_γ) are included. (R.V.J.)

21113

ON DISTORTIONS OF COMPLETE ENERGY LINES BY NaI(Tl) CRYSTALS. Yu. A. Nemilov, A. N. Pisarevskiĭ, and L. D. Soshin (Radium Inst., Academy of Sciences,

USSR). Pribory i Tekh. Ekspt. No. 4, 72-3(1959) July-Aug. (In Russian)

Studies were made of the observed "doubling" caused by some NaI(Tl) crystals in complete energy lines. The expanded "doubling" is shown graphically. It was found that moisture and reorientation can cause the doubling effect. (R.V.J.)

21114

APPARATUS FOR INDIVIDUAL LUMINESCENCE DOSIMETRY CONTROL ILK-3. I. P. Belov, K. S. Kalugin, I. B. Keirim-Markus, V. I. Nikiforov, and M. S. Poroshina. Pribory i Tekh. Ekspt. No. 4, 74-80 (1959) July-Aug. (In Russian)

The design and construction are described of a new apparatus for measuring individual fluorescence dosimeters under ordinary light. The infrared light and photocurrent integrated into a memory device are used. The device has three dosage measuring ranges, 0.2, 2, and 20r. By decreasing the infrared light intensity by a factor of 100, the measuring range is raised to 2000r. (R.V.J.)

21115

A DEVICE FOR AUTOMATIC RECORDING OF PULSES. G. M. Gorodinskiĭ and V. A. Kochevanov (Leningrad State Univ.). Pribory i Tekh. Ekspt. No. 4, 81-5(1959) July-Aug. (In Russian)

Descriptions are given of a device for automatically counting statistically distributed pulses. The pulses coming from a transducer to the entrance of the device at equal intervals of time are recorded as a histogram recording ribbon on the EPP-9 potentiometer. The measuring range (with a scaling scheme of 1 : 256) is from 50 to 1.3×10^6 pulses per scale. The exposition time varies from 2 sec to 16 min. The order of precision is ~1%. (tr-auth)

21116

HIGH-FREQUENCY ION SOURCE. N. S. Nazarov (Inst. of Physics, Academy of Sciences, Ukrainian, SSR). Pribory i Tekh. Ekspt. No. 4, 93-5(1959) July-Aug. (In Russian)

The high-frequency ion source, with transverse high frequency and longitudinal "resonance" magnetic field, produces a 300 to 350 μa current at targets placed 2.7 m from the source with a gas rate ~1 cm^3/hr. The gas utilization factor is <0.3. The performance of the source was tested with low voltage (~100 kv). It is recommended for both low voltage installations and electrostatic generators. (tr-auth)

21117

DOUBLE FOCUSING OF CHARGED PARTICLE BEAM IN A WIDE INTERPOLAR GAP. S. A. Kuchaĭ. Pribory i Tekh. Ekspt. No. 4, 97-9(1959) July-Aug. (In Russian)

Experiments were conducted for demonstrating the presence of double-geometric focusing between the poles of a magnet with a wide gap. (tr-auth)

21118

FILAMENT SCINTILLATOR IN LUMINESCENCE CHAMBER. O. V. Savchenko (Joint Inst. of Nuclear Research, Dubna, USSR). Pribory i Tekh. Ekspt. No. 4, 142-3(1959) July-Aug. (In Russian)

Fiber optics are suggested as means for increasing the light power of scintillators. An optical system composed of a number of fluorescent filaments closely adjoining the end window of the light amplifier is proposed. A flash of light, evenly distributed in all directions, appears with the passage of an ionizing particle through each filament. On the surface formed by the filament edger a light image appears which is the projection of the particle trajectories. When the filaments are properly distributed it is possible to reproduce the track of an ionizing particle in three dimensions. (R.V.J.)

21119

A MINIATURE DEVICE FOR DEVELOPING STRONG MAGNETIC FIELDS. N. V. Volkenshteĭn and M. I. Turchinskaya (Inst. of Physics of Metals, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 4, 152-3 (1959) July-Aug. (In Russian)

An apparatus capable of measuring thermo- and galvano-magnetic effects in a wide range of temperature up to helium is described. The device placed in a 2000 gauss solenoidal field develops a 24,000 gauss field in a 0.2 mm gap. The dependence of the field in a 0.21 mm gap on the external (solenoidal) field for semi-ellipsoids of various magnitudes and materials is plotted. (R.V.J.)

21120

SOME LIQUIDS FOR USE IN LARGE BUBBLE CHAMBERS. B. Hahn, G. Riepe, and A. W. Knudsen (Univ. of Fribourg, Switzerland). Rev. Sci. Instr. 30, 654-5 (1959) Aug.

The liquids C_3F_8, C_4F_{10}, SF_6, C_2ClF_5, and $CBrF_3$, and mixtures of SF_6 with C_2ClF_5 were found to possess a number of desirable properties for use in large bubble chambers, designed primarily for particle decay studies. These properties are relatively short radiation length, convenient operating pressure and temperature, chemical inertness, and nontoxicity. Some properties of TeF_6 are also discussed. (auth)

21121

AUTOMATIC SCANNING INSTRUMENT FOR X-RAY LOW-ANGLE SCATTER. B. L. Beck and E. L. Gunn (Humble Oil and Refining Co., Baytown, Tex.). Rev. Sci. Instr. 30, 662-4(1959) Aug.

An automatic scanning instrument for x-ray low-angle scatter measurements was designed which provides high resolution and precision with relatively little effort in semiroutine operation. The apparatus employs Kratky optical geometry and a scintillation counter detector mounted on a variable speed scanning mechanism. The intensity of scattered radiation as a function of angle is plotted on a strip-chart recorder. The method of operation and examples of instrumental performance are presented. (auth)

21122

COUNTER TELESCOPE EFFICIENCY CALCULATION FOR A NONISOTROPIC NEUTRON SOURCE. E. Haddad and John L. Warren (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 30, 664-9(1959) Aug.

The measurement of neutron cross sections with a counter telescope involves a calculation of telescope efficiency. Equations are derived for a nonisotropic point source of neutrons. The efficiency equations were evaluated by means of an IBM 704 computer for various experimental conditions and the results are presented in tables. (auth)

21123

ATOMIC-BEAM MAGNET-STABILIZATION SYSTEM. Gilbert O. Brink and N. Braslau (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 670-4(1959) Aug.

A system is described which allows the magnetic field of the "C" magnet of an atomic-beam magnetic-

resonance apparatus to be locked to a resonance in the beam. The construction of the system is discussed and representative performance data are presented. (auth)

21124

HIGH-VOLTAGE, LOW-INDUCTANCE SWITCH FOR MEGAMPERE PULSE CURRENTS. William R. Baker (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 700-2(1959) Aug.

A switch is described that will handle pulse currents of several millions of amperes and stand off d-c supply voltages of over thirty kilovolts. It is useful in powering fast pinch devices such as those used in thermonuclear research. (auth)

21125

ANGULAR CORRELATION AND ANGULAR DISTRIBUTION ATTENUATION COEFFICIENTS. A. L. Stanford, Jr. and W. K. Rivers, Jr. (Georgia Inst. of Tech., Atlanta). Rev. Sci. Instr. 30, 719-21(1959) Aug.

Attenuation coefficients for angular correlation measurements and angular distribution measurements were calculated for sodium iodide crystals of 1.5-in. diam and various heights. The crystals considered are right circular cylinders of heights 1.0, 1.25, and 1.5 in. Eleven photon energies in the range from 0.05 to 5.0 Mev were used. Attenuation coefficients for crystals of diameters other than 1.5 in. may be obtained from these results. (auth)

21126

IMPROVEMENTS IN THE MICROWAVE PROPAGATION METHOD OF STUDYING DECAYING GAS PLASMAS. Susumu Takeda and E. Howard Holt (Univ. of Illinois, Urbana). Rev. Sci. Instr. 30, 722-5(1959) Aug.

Some improvements in measuring the transient values of the electron density in decaying gas plasmas by the propagation method are described. The electron density, as is known, can be calculated from measurements of phase shift and attenuation of a probing microwave signal propagated through the plasma. The increase of the detection sensitivity of very small phase shifts (X-band microwave) leads to at least a tenfold decrease in electron density measurement. Thus, in a ten-inch long discharge tube densities of $10^{11}-10^{8}$ cm^{-3} are measured, which is comparable to that by the cavity method at the same frequency. (auth)

21127

ELIMINATION OF THE $\alpha_1\alpha_2$ DOUBLET IN X-RAY PATTERNS. David T. Keating (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 30, 725-7(1959) Aug.

The characteristic K-radiation employed in x-ray diffraction consists of the bichromatic wavelengths $\lambda(\alpha_1)$ and $\lambda(\alpha_2)$. In practice the observed diffraction pattern is the superposition of the patterns of the two components. In many cases it is necessary to determine the diffraction pattern for a single wavelength. An analytical method for determining such a pattern from the observed superimposed pattern was developed. The method can be applied to eliminate the doublet from the entire pattern or any particular section. The method can be used to correct diffraction patterns used in their entirety in radial distribution analysis, and is also very useful in line profile work and lattice parameter determinations. (auth)

21128

CORONA COUNTER FOR THERMAL NEUTRONS. C. W. Peters and F. E. Jablonski (Naval Research Lab., Washington, D. C.). Rev. Sci. Instr. 30, 728-31(1959) Aug.

The characteristics of a double-plate, corona counter with a boron-coated cathode were investigated with regard to variation of wire spacing, anode-to-cathode spacing, gas flow, and air pressure. A counter designed to detect a thin neutron beam of 0.0002 cm^2 cross section is described. The sensitivity of each wire in this counter was investigated. This counter was life tested with a nitrogen filling for over 1500 hr or a total of 10^7 counts. (auth)

21129

CURVE INTEGRATOR. William G. Soper (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 30, 742(1959) Aug.

An accurate, inexpensive device is described for integrating a function expressed as a curve in rectilinear coordinates. The only precision part of the device is taken, without modification, from a common polar planimeter. (D.E.B.)

21130

CHARGER-READER FOR POCKET CHAMBERS. J. Handloser, W. A. Higinbotham, and E. Rainey (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 30, 746-7(1959) Aug.

A charger-reader containing a large meter and built for rugged durability reduces operator fatigue and speeds up operations. (C.J.G.)

21131

NOMOGRAPH FOR TIME-OF-FLIGHT MEASUREMENTS OF FAST NEUTRONS. R. E. Holland (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 30, 747-8(1959) Aug.

The nomograph, when used with a graphical presentation of the data, allows an estimate to be made of the energy of a particular neutron group. The error is usually less than a few percent for the system. (C.J.G.)

21132

FLUORESCENCE DECAY TIME IN Tl-ACTIVATED INORGANIC SCINTILLATION CRYSTALS FOR PARTICLES OF VARIOUS IONIZATION DENSITY. M. Bormann, G. Andersson-Lindström, H. Neuert, and H. Pollehn (Physikalisches Staatsinstitut, Hamburg). Z. Naturforsch. 14a, 681-3(1959) July. (In German)

The effect of ionization density on the decay time in CsI(Tl), KI(Tl), and NaI(Tl) crystals was investigated at room temperature. Alpha particles of 4 Mev, protons of 2.7 Mev, and the electrons liberated in the crystal by ThC'' gamma radiation were used as characteristic particles. The effect was determined by a measurement of the rise time of the pulse to its complete height. The results show a dependence of the pulse rise on the particle type in all three crystals. The particles of highest ionization density produced the most rapid pulse rise. The effect is most decided in the CsI(Tl) crystals. The method for the measurement of the pulse was simplified for the CsI(Tl) crystals. (J.S.R.)

21133

ON A PRINCIPLE OF GROUPING OF HIGH-VELOCITY ELECTRONS. S. P. Kapitsa (Moscow Lab. of Physics, Academy of Sciences, USSR). Zhur. Tekh. Fiz. 29, 729-31(1959) June. (In Russian)

The method of electron grouping, based on conversion of electron velocity rate modulation into density modulation in space flight motion, cannot be efficiently adapted

for relativistic electrons. A method is suggested based on the ratio of electron rotation time in a magnetic field to their total energy. This mechanism is developed using the standard theory of grouping. (R.V.J.)

21134

ELECTRON BEAM EQUILIBRIUM. V. S. Anastasevich. Zhur. Tekh. Fiz. 29, 738-44(1959) June. (In Russian)

The conditions for which the density of secondary particles is higher than that of the primary electrons are determined. The electron beam equilibrium factor is found for the case when the density of secondary particles is considerably higher than the density of primary electrons. (R.V.J.)

21135

PROPAGATION PERTURBATIONS IN ONE-DIMENSIONAL, DOUBLE-BEAM ELECTRON STREAM. Chang Jih-Ming (Moscow State Univ.). Zhur. Tekh. Fiz. 29, 745-55(1959) June. (In Russian)

The solution is derived for the propagation of perturbations in a one-dimensional, double-beam electron stream with arbitrary potential distribution. The linear potential distribution, the distribution defined by the stream charge, and the constant potential in space (drag) are studied. The drag problem is solved considering the presence of an outside field. (tr-auth)

21136

INVESTIGATION OF OUTGASSING FROM METALS BY PULSE MASS SPECTROSCOPE. Yu. I. Belyakov and E. I. Agishev (Leningrad State Univ.). Zhur. Tekh. Fiz. 29, 796-8(1959) June. (In Russian)

Experiments were carried out with IMS (impulse mass spectrometer without magnet) in order to determine the characteristics of outgassing for several types of cathode nickel under rapid heating in a vacuum. It was found that the kinetics of outgassing in the initial stages does not depend on the brand of nickel, but on the method of surface treatment. The quantity of outgassed CO and CO_2 depends on the brand and the method of treatment. Graphs of gas outgassed from electrolytic nickel and silicon nickel treated by aqua regia, chromium mixture, and electrical polishing are plotted. (R.V.J.)

21137

IMPROVEMENTS IN OR RELATING TO ROTARY APPARATUS. Vladimir Herbert Brix (to United Kingdom Atomic Energy Authority). British Patent 815,923. July 1, 1959.

An arrangement of drive shaft, impeller, and gas seals for canned-rotor pump is described. The partition between impeller and drive is penetrated by a sleeve journal bearing. A gas connection is provided for feeding a barrier and lubricating gas into the journal. (T.R.H.)

21138

METHOD AND APPARATUS FOR MEASURING THE THICKNESS OF A DEPOSIT. (to Commissariat à l'Énergie Atomique). British Patent 816,062. July 8, 1959.

A radiometric thickness gage is described which measures the intensity of a narrow band of x rays excited by β particles. The deposited layer whose thickness is to be measured is bombarded by a beta source and a portion of the x-ray spectrum thus excited is measured. (T.R.H.)

21139

RADIATION DETECTORS. Charles Walter Munday (to Distillers Co., Ltd.). British Patent 816,849. July 22, 1959.

A selective radiation detector is described which measures the energy content of certain wavelengths of chopped radiation. The device consists of two chambers connected by a passage containing electrically heated temperature sensitive elements. Windows in the chambers admit chopped beams which heat the filling fluid intermittently causing a pulsating movement of fluid through the connecting passage, thereby causing temperature changes in the elements. The device can be used in a chopped double-beam radiation absorption fluid analyzer. (T.R.H.)

21140

PROCESS FOR RECOVERY OF CONSTITUENTS OF ORES. Robert F. McCullough (to U. S. Atomic Energy Commission). U. S. Patent 2,885,259. May 5, 1959.

A process for U recovery from leached zone material is described. Calcination with alkali metal carbonate at 600 to 2000°F followed by digestion with H_2SO_4 and filtration forms the basis of the process. (T.R.H.)

21141

LOW-LEVEL DIRECT CURRENT AMPLIFIER. Quentin A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 2,885,496. May 5, 1959.

A d-c amplifier is described. Modulation is provided between a d-c signal and an alternating current to give an output signal proportional to the d-c signal. The circuit has high sensitivity and accuracy. (T.R.H.)

21142

DRIFT COMPENSATED DIRECT COUPLED AMPLIFIER. Alfred A. Windsor (to U. S. Atomic Energy Commission). U. S. Patent 2,885,497. May 5, 1959.

An improved direct-coupled amplifier having zero-level drift correction is described. The need for an auxiliary corrective-potential amplifier is eliminated thereby giving protection against overload saturation of the zero-level drift correcting circuit. (T.R.H.)

21143

PARTICLE BEAM TRACKING CIRCUIT. Oscar A. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,885,552. May 5, 1959.

A particle-beam tracking and correcting circuit is described. Beam induction electrodes are placed on either side of the beam, and potentials induced by the beam are compared in a voltage comparator or discriminator. This comparison produces an error signal which modifies the fm curve at the voltage applied to the drift tube, thereby returning the orbit to the preferred position. The arrangement serves also to synchronize accelerating frequency and magnetic field growth. (T.R.H.)

21144

INSPECTION APPARATUS. Arthur J. Kizaur (to General Electric Co.). U. S. Patent 2,885,557. May 5, 1959.

A mechanical device for successively placing objects to be x-ray radiographed between an x-ray source and a detector is presented. The samples, such as an explosive projectile, are rotated on a wheel to inspection stations, twirled with respect to the scanning beam, and moved in the direction of the axis of scanning. Thus the beam traverses the sample in an encompassing helical path. (T.R.H.)

21145

PHOTOELECTRIC DEVICE. John C. Marinace and

Ubert Cocca (to General Electric Co.). U. S. Patent 2,885,562. May 5, 1959.

A radiation detector made up of a p-type semiconductor layer and a phosphorescent n-type layer is described. The p-type material may be Se with Al electrode bonded to it by a Bi layer. The n-type material is Ag-activated CdSe or CdS. One cell exposed to 50,000 r of 140-kv x radiation produced 0.2 μ amp photovoltaically and 5.3 μ amp photoconductively. Photovoltaic operation of the device may be applied to monitoring or safety applications. The photoconductive character makes it useful where accessory equipment can be used. (T.R.H.)

21146

PULSED NUCLEAR INDUCTION SPIN ECHO TECHNIQUE. Erwin L. Hahn. U. S. Patent 2,887,673. May 19, 1959.

An apparatus is described which analyzes chemical compounds by detection of induced spin-echo signals from atomic nuclei. (T.R.H.)

21147

APPARATUS FOR TESTING EXPANSION OF MOVABLE MEMBERS. Melvin Frankel and Walter Bradford Shank (to U. S. Atomic Energy Commission). U. S. Patent 2,887,876. May 26, 1959.

A device is described for measuring the swelling of slug elements in the channels of a reactor. It consists of hydraulically operated pistons at the ends of the channel which move the row of slugs back and forth. The resistance to moving is indicated by the pressure required to move the slugs. As the slugs swell, the resistance increases and a higher pressure is read on the gage. (T.R.H.)

21148

VACUUM PUMP. Raymond G. Herb (to Wisconsin Alumni Research Foundation). U. S. Patent 2,888,189. May 26, 1959.

An ion pump is described which offers faster pumping speeds. It is believed that the improved action results from the geometry. A magnetic field is provided in the area where ionization by the electron beam takes place so that the electrons travel a spiral path thereby enhancing the ionization. A reflector (re-evaporator) for the getter material circumscribes the evaporator post and serves to break up the particles so that the gettering material is deposited finely. The surface on which the gas is collected is cooled to improve gettering. This pump provides a speed of 250 l of Ar per min compared to 9 for an earlier version. (T.R.H.)

21149

NUCLEAR SPECTROSCOPY WELL LOGGING. Stanley B. Jones and Walter E. Meyerhoff (to California Research Corp.). U. S. Patent 2,888,568. May 26, 1959.

An improved combination of well-logging apparatus is suggested. The equipment includes a scintillation counter, a linear amplifier, an electronic differential discriminator or an oscilloscope and camera which will measure and indicate the relative number of scintillations giving rise to pulses of a particular value. Thus pulse heights corresponding to the elements contained in the earth formation traversed are recorded. (T.R.H.)

21150

RADIOACTIVITY MEASURING. Roy P. Mazzagatti, O. D. Stephens, and Archie S. Conners (to The Texas Co.). U. S. Patent 2,888,571. May 26, 1959.

A filler composition for gas-filled gamma detectors which shortens the dead-time is offered. Experiments show that a 3% anhydrous NH_3, 20% Ar, and 77% He gives a dead time of 50 μsec and a higher peak signal amplitude. (T.R.H.)

21151

TRIGGERED PULSE GENERATOR. Laurin G. Fischer and Richard C. Neunzig (to International Telephone and Telegraph Corp.). U. S. Patent 2,889,457. June 2, 1959.

A fast-recovery triggered pulse generator is described which is responsive to input pulses of either polarity and produces pulses of either polarity. The exponential waveform is generated at the grid of the second tube. The feedback from the second tube produces sharp pulses corresponding to the leading and trailing edges of output pulses from the second tube. Only the leading edge pulse is fed back so that a sharp pulse which does not interfere with incoming pulses is applied to the first tube. (T.R.H.)

21152

SHIELDING MANIPULATOR FOR RADIO-ACTIVE MATERIAL. William G. Ruehle, Jr. (to Lermac, Inc.). U. S. Patent 2,889,464. June 2, 1959.

A shielded manipulator arrangement is described which overcomes the size limitations of lead ball-and-socket manipulators. The device consists of a heavy-metal cylinder mounted on bearings in the shield wall with its axis vertical. The cylinder has a vertical slice removed from its center so that a heavy-metal disc fits in on edge. The disc is bored diametrally to receive the manipulating tongs and is also provided with bearings to ease vertical movement of the tongs. The movement of the cylinder provides lateral manipulation. The pieces are so fitted with curved interfaces that radiation does not escape through cracks. (T.R.H.)

21153

PULSE GENERATING DEVICE. Thomas E. Myers. U. S. Patent 2,889,472. June 2, 1959.

An electric pulse generator simple in construction is described. It consists of a first circuit which has a load, a coil-operated relay, and a delay means to delay release after de-energizing of the coil. A second relay opens and closes the circuit through the first coil and its own coil. The second relay has a delay, too. The coil of each relay has a condenser in parallel and a permanent magnet. Adjustment of magnet position varies the delay time of the relay. Thus pulses are generated at controlled but variable time intervals. (T.R.H.)

21154

HIGH VOLTAGE REGULATOR. Byron T. Wright (to U. S. Atomic Energy Commission). U. S. Patent 2,890,338. June 9, 1959.

A high voltage regulator for use with calutrons is described which rapidly restores accelerating voltage after a sudden drop such as is caused by sparking. The rapid restoration characteristic prevents excessive contamination of lighter mass receiver pockets by the heavier mass portion of the beam. (T.R.H.)

21155

CALUTRON PLANT ARRANGEMENT. Leslie O. Waite (to U. S. Atomic Energy Commission). U. S. Patent 2,890,341. June 9, 1959.

A description is given of an arrangement for calutrons in which the tanks and magnets are placed alternately in a "race track" figure. Pump connections are through the floor to the pumps below where roughing and finish-

ing headers are provided. The arrangement provides more efficient and economical operation, economy of construction, and saving of space. (T.R.H.)

ISOTOPES—INDUSTRIAL TECHNOLOGY

21156

METHODS OF STUDYING DIFFUSION WITH THE AID OF RADIOACTIVE ISOTOPES. Josef Cadek and Emil Janda (Vyzkumny ustav hutnictvi zeleza, Prague). Hutnické listy 12, 1008-20(1957). (Translated from Referat. Zhur. Fiz. No. 6, 1958, Abstract No. 13189.)

Methods for measuring the coefficient of diffusion with the aid of radioactive isotopes were examined. In some of these methods, the use of radioactive isotopes contributes to an increased sensitivity, accuracy, and speed. Other methods are based on the interaction between the radioactive radiation and the substance. These methods, called absorption methods, are suitable particularly because their use requires neither subdivision of the specimens into a layer nor exact measurements of small distances. (auth)

21157

INVESTIGATION AND CONTROL OF THE BLAST FURNACE PROCESS USING RADIOACTIVE ISOTOPES AND RADIATIONS. P. L. Gruzin, V. N. Afanas'yev, and S. V. Zemskii. Stal No. 4, 291-7(1959).

A brief review is given of the application of radioactive sources in the USSR for the investigation and control of blast furnace processes. (J.S.R.)

21158

CONTEMPORARY EQUIPMENT FOR WORK WITH RADIOACTIVE ISOTOPES. Collected Reports. Translated from Atomnaya Energ., Suppl. No. 5 (1958). New York, Consultants Bureau, Inc. 67p. $15.00.

One hundred ten radioactive isotopes were produced in the U.S.S.R. during 1958. These isotopes were used in all branches of science and technology. Methods and technological procedures are described which were used in the production of isotopes and the preparation of labeled compounds from them. Shielding and manipulative devices for work with radioactive isotopes are described and illustrated photographically. (C.H.)

METALLURGY AND CERAMICS

21159 AD-153566

Illinois. Univ., Urbana.

HIGH-TEMPERATURE ELECTRICAL INSULATING INORGANIC COATINGS ON WIRE. Quarterly Progress Report No. 3 [for] August 16, 1957 to November 15, 1957. C. G. Bergeron, A. L. Friedberg, and W. M. Faber. 20p. Project No. 7-(8-7350). Contract AF33-(616)-3943.

The equipment for continuously applying and firing a vitreous coating onto copper wire was completed, and numerous trial runs were made. Preliminary studies were made of the effect of such processing variables as nitrogen flow, furnace temperature, wire speed, and coating thickness on the flexibility and dielectric properties of the coated wire. (auth)

21160 AECU-4284

Denver. Univ. Denver Research Inst.

THE DETERMINATION OF THE EQUILIBRIUM PHASE DIAGRAM, ZIRCONIUM-NIOBIUM. Period Covered: July 1 to August 1, 1959. C. E. Lundin. Aug. 10, 1959. 5p. Contract AT(11-1)-752. $1.80(ph), $1.80(mf) OTS.

Investigation of the allotropic phase in Zr metal is reported along with the development of metallographic etchants. Also, an examination of the first Nb–Zr as-cast buttons is reported. Data are included on transformation microstructures in reactor-grade Zr. (J.R.D.)

21161 AECU-4290

Denver. Univ. Denver Research Inst.

STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON–ALUMINUM ALLOYS. [Period Covered] March 15, 1959 to March 15, 1960. Frank C. Perkins and J. F. Nachman. Aug. 10, 1959. 9p. Contract AT(11-1)-742. $1.80(ph), $1.80(mf) OTS.

A program to determine the effect of variations of Al content, heat treatment, and basic slip mechanism upon room temperature ductility of Fe–Al alloys is reported. (W.L.H.)

21162 AECU-4354

Knolls Atomic Power Lab., Schenectady, N. Y.

USING CERAMICS AND CERMETS IN NUCLEAR POWER REACTORS. George L. Ploetz. [nd]. 21p. $3.30(ph), $2.40(mf) OTS.

The types of ceramic materials that are being applied to nuclear reactors for fuel elements, control rods, burnable poisons, moderators, reflectors, and shielding are discussed in detail. Structural applications such as special electrical insulation and thermal insulation as well as the use of special optical requirements are reported. (W.L.H.)

21163 AFOSR-TR-59-91

Illinois Inst. of Tech., Chicago.

AN INVESTIGATION OF FATIGUE PHENOMENA IN METALS BY MEANS OF A RECRYSTALLIZATION TECHNIQUE. Technical Report No. 1. J. L. Peterson and N. H. Polakowski. Apr. 1959. 68p. Contract AF18(603)-68.

Experiments were conducted to determine the effect of combined static cold working and fatigue on the recrystallization behavior of several polycrystalline metals as indicated by the annealed grain size. The relationship between the annealed grain size and undirectional deformation was reaffirmed and the critical deformation to initiate recrystallization was determined. Both annealed and cold worked metals were subjected to alternating strains of amplitudes varying from those used in conventional fatigue tests to ±2% per cycle. They were then recrystallized to determine the effects of the cyclic stressing on the annealed grain size. The most pronounced changes were observed in annealed metals and especially in low carbon steel. Metals deformed more than the initial amount for recrystallization were softened under the action of cyclic strain to hardness levels corresponding to deformations less than the critical amount required for recrystallization. However, recrystallization could not be suppressed in this manner. Other manifestations of fatigue softening were reviewed and related to the present findings. A substructure hypothesis was utilized to explain the property changes resulting from the fatigue of cold worked metals. A hypothesis based on possible polygonization and sub-structure formation in statically deformed metals under cyclic stress was advanced to account for the different effects of fatigue softening on mechanical properties on one hand and the recrystallization capacity on the other. (auth)

21164 AGC-1537

Aerojet-General Corp., Azusa, Calif.

MEASUREMENTS OF MECHANICAL PROPERTIES OF PURE AND URANIUM-LOADED GRAPHITES AT ELEVATED TEMPERATURES. Final Report [for] June 27, 1957 through December 15, 1958. Leon Green, Jr., Melvin L. Stehsel, and Cecil E. Waller. Dec. 23, 1958. 145p. For Los Alamos Scientific Lab. [Sub]contract CTU-86039-1. $22.80(ph), $7.20(mf) OTS.

Various mechanical-property measurements on several grades of manufactured (polycrystalline) graphite stock include tensile-strength determinations at temperatures from 20 to 2400°C (plus a few at 2500°C), tensile stress-strain and creep tests in the range 2000 to 2400°C, torsional strength and stress-strain measurements from 20 to 2600°C, torsional creep and stress-relaxation tests in the range from 2000 to 2800°C, dynamic Young's-modulus determinations from 20 to 2450°C, and evaluation of average coefficients of linear thermal expansion for the ranges 20 to 1050°C and 1300 to 2400°C. The materials studied include a commercial grade of graphite (Great Lakes Carbon Co. Grade H4LM) molded in 36-in.-diam pieces, both as the standard stock with a nominal density of 1.74 g/cc and as stock re-impregnated to a nominal density of 1.80 to 1.85 g/cc, and four grades of graphite manufactured by the Los Alamos Scientific Laboratory containing normal uranium (added as UO_2 during the manufacture) in varying concentrations. The tensile-strength and creep data obtained are compared with the results of Los Alamos measurements upon similar materials. (auth)

21165 ANL-5872

Argonne National Lab., Lemont, Ill.

THE RADIAL DISTRIBUTION OF THERMAL NEUTRON FLUX IN CYLINDRICAL FUEL SPECIMENS DURING NEUTRON IRRADIATION. Frank R. Taraba and S. Hugh Paine. Aug. 1, 1959. 38p. Contract W-31-109-eng-38. $1.25(OTS).

A systematic study of the radial distribution of thermal neutrons in cylindrical fuel specimens during irradiation has been made. Natural uranium and alloys of magnesium–cadmium were used in the investigation. The alloys were used to simulate the absorption properties of reactor fuel materials. Effects of the variable cylinder radius, a, and macroscopic absorption cross section, Σ_{abs}, in the range $0 < \omega < 2.2$, where $\omega = a\Sigma_{abs}$, were studied. It was found that the experimentally determined radial distributions of the thermal neutron flux may be expressed by an empirical formula of the type $n(r,\omega) = \sum_{k=0}^{3} a_k(\omega) r^{2k}$ for $r \leq a$, and $0 < \omega < 2.2$. The functions $a_k(\omega)$ are given by $a_k(\omega) = a^{-2k}\gamma^k / \sum_{j=0}^{3} \gamma^j$, where $\gamma = \omega/(-0.22894\omega^2 + 0.63812\omega + 1.2567)$. The neutron flux is set equal to unity at the surface of the cylinder, i.e., $n(a,\omega) = 1$ for all ω. (auth)

21166 ANL-5971

Argonne National Lab., Lemont, Ill.

SELF-DIFFUSION IN GAMMA URANIUM. S. J. Rothman, L. T. Lloyd, R. Weil, and A. L. Harkness. July 1959. 39p. Contract W-31-109-eng-38. $1.25(OTS).

The self-diffusion coefficient of uranium was measured at four temperatures in the gamma phase. The data are fitted by an Arrhenius-type equation $D = 2.33 \times 10^{-3}$ cm 2/sec exp (−28,500 cal per mole/RT) and agree well with previously reported results. The value of D_0 is lower than that predicted by Zener's theory, and the activation energy is much less than the value expected from various empirical correlations. (auth)

21167 ARF-6039-4

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

INVESTIGATION OF GRAPHITE BODIES. Progress Report No. 4 for period June 1, 1959 to August 31, 1959. S. W. Bradstreet. Sept. 1, 1959. Includes Appendix I: INVESTIGATION OF SYNTHETIC BINDERS BY DIFFERENTIAL THERMAL ANALYSIS AND DILATOMETRY. H. Henry Nakamura and Leon M. Atlas. 49p. Contract AF33(616)-6143.

Preliminary data are presented illustrating the properties of molded multicrystalline graphite made using calcined petroleum coke (in some instances mixed with a thermal carbon) bonded with coal tar pitch, furfuryl alcohol, or limited mixtures of the two. No conclusions have yet been drawn regarding the relation between these properties, since a large number of specimens remain to be measured. Most obvious is the difficulty of achieving a sound structure from bodies of maximum green density, particularly when the binder is not thermoplastic. Graphitized specimens made with furfuryl alcohol reflect the high density of the binder coke. X-ray data show that this coke is poorly graphitizable as compared to pitch; modulus and electrical resistance data show it to be more dense. A full description of the use of differential thermal analysis and dilatometry in investigating the behavior of thermosetting resins is appended. For preceding period see ARF-6039-3. (auth)

21168 BMI-1327

Battelle Memorial Inst., Columbus, Ohio.

THE PREPARATION AND PROPERTIES OF THREE REFRACTORY BERYLLIDES. Walston Chubb and Ronald F. Dickerson. Mar. 3, 1959. 20p. Contract W-7405-eng-92. $0.75(OTS).

The beryllium compounds $NbBe_{12}$, YBe_{13}, and $ZrBe_{13}$ were prepared by arc melting. Some beryllium was lost in this operation but sound ingots were obtained. The hardness, density, metallographic structure, x-ray structure, and oxidation resistance in air of each ingot were determined. The zirconium compound apparently had a tetragonal structure corresponding to $ZrBe_{13}$ and a hardness of 790 Knoop and a density of 2.94 g per cm^3. The yttrium compound had a cubic structure corresponding to YBe_{13} and a hardness of 870 Knoop and a density of 2.57 g per cm^3. The niobium compound had a tetragonal structure corresponding to $NbBe_{12}$ and a hardness of 1100 Knoop and a density of 3.14 g per cm^3. The zirconium alloy was most difficult to prepare and crumbled at 700°C during oxidation testing. The niobium and yttrium alloys were both relatively easy to prepare and both were highly resistant to oxidation at 1300°C. The niobium alloy had the most satisfactory behavior in all respects and appears most promising for further development. (auth)

21169 BMI-1346

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MAY 1959. Russell W. Dayton and Clyde R. Tipton, Jr. June 1, 1959. Decl. July 17, 1959. 105p. Contract W-7405-eng-92. $2.50(OTS).

Data are presented on the electrical conductivity of unirradiated UO_2. A study of the creep properties of annealed and of 15% cold-worked Zircaloy-2 at 290, 345, and 400°C is in progress. High-purity Mo single crystals are being grown in a modified Andrade fur-

nace. Research to develop a method of sink-float density measurement to identify factors affecting irradiation-induced volume changes in graphite was continued. The simulation of conditions after a loss-of-coolant incident in the PRTR by means of a digital computer was continued. Tensile data are given on Al–35 wt. % U alloys with 3 wt. % ternary additions of Si, Sn, and Zr. Work was continued on the free-radical and peroxy grafting of polymethylmethacrylate and polyacetylmethacrylate. The manner in which uranium solidifies in cylindrical graphite molds is being studied. An investigation is being made of the effect of oxide additions (CaO and La_2O_3) to UO_2 in preventing the transformation and volatility associated with the formation of U_3O_8 during oxidation. Postirradiation studies are in progress on the specimens of hydrided Zr–2 wt. % U which were irradiated in the MTR. An irradiation-surveillance program is being conducted on AISI Type 347 stainless steel. An evaluation of several Nb-base alloys for possible application as alternate cladding material in future EBR cores is being made. Corrosion data are presented for commercial purity Nb–Zr, Nb–W, Nb–Mo, Nb–V, Nb–Fe, Nb–Ti, Nb–Ti–Cr, Nb–Ti–Mo, and Nb–Ti–V alloys in 750°F steam and 680°F water. Corrosion data are reported for Nb–U alloys in air and in water after 14 and 28 days exposure. Thermal analysis data are presented for Th–U–Zr and Th–U–Zr–Nb alloys. Specimens of single-crystal UO_2 are being prepared for study of fission-gas diffusion coefficients by low temperature irradiation and subsequent heating to collect the fission gases. The gas-pressure bonding technique is being studied as a possible method for cladding ceramic and cermet fuels with Mo and Nb. The high-temperature irradiation behavior of dispersion fuel elements consisting of 24 wt. % UN or UC dispersed in stainless steel and clad with stainless steel is being evaluated. The solid-state bonding of metals by application of heat and pressure is being studied in an attempt to establish the mechanism and kinetics of the process. Data are presented on the green compacting of UO_2 powders under various conditions. Several methods of fabricating UC of high density are being studied. Data are presented on the effects of impurities on some properties of cast UC. A program to obtain basic fatigue information on Inconel is presented. A program concerned with the investigation of the temperature and frequency dependence of fatigue properties of INOR-8 alloy is reported. Preliminary experiments were conducted with the apparatus designed for the study of the migration of hydrogen in Zr under the influence of a thermal gradient. Fueled-graphite spheres are being evaluated with respect to selected thermal and mechanical properties. Irradiation data are presented on UC specimens. A Zircaloy-2-clad compartmented flat-plate fuel element containing UO_2 cores is being considered for the PWR Core-2. Techniques are being investigated for use in the fabrication of fuel elements containing cores of 26 wt. % UO_2–1.1 wt. % ZrB_2 dispersed in a prealloyed Type 347 stainless steel matrix. (For preceding period see BMI-1340.) (W.L.H.)

21170 BMI-1357

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JUNE 1959. Russell W. Dayton and Clyde R. Tipton, Jr. July 1, 1959. Decl. Aug. 11, 1959. 109p. Contract W-7405-eng-92. $2.50(OTS).

The study of the creep properties of annealed and of 15% cold-worked Zircaloy-2 at 290, 345, and 400°C is being continued. Research to identify factors affecting irradiation-induced volume changes in graphite by means of sink-float density measurements was continued. The program to simulate conditions after a postulated loss-of coolant incident within the PRTR was completed. Lapsed-time motion pictures are being made through a windowed autoclave of the corrosive action of high-temperature water on defected Zircaloy-2 U specimens. Progress on the development of an isotopic-exchange leak-detection systems is summarized. A program to develop a thermal-neutron-flux monitoring system for the Hanford reactors is reported. A project is being conducted to determine the temperature and approximate composition of the ternary eutectic in the Al–U–Ni alloys. A feasibility study to determine if Ca coatings can be successfully put on Ni by arc-spraying methods is reported. Work was continued on the valence effects of oxide additions (CaO and La_2O_3) to UO_2. An investigation is being made of the effects of combined high pressure and temperature on UO_2. Postirradiation data are presented on fueled specimens of $ZrH_{1.65}$–2 wt.% U. An evaluation of the effect of irradiation on the mechanical properties of AISI Type 347 stainless steel is being conducted. Hot-hardness data are presented for high-purity Nb, Nb–Zr, Nb–V, Nb–Ti, Nb–Fe, Nb–Cr, Nb–V–Ti, Nb–V–Mo, Nb–V–Fe, Nb–V–Cr, Nb–V–Al, Nb–Zr–V, Nb–Zr–Ti, Nb–Zr–Mo, Nb–Zr–Cr, and Nb–Zr–Fe. A summary is presented of corrosion results obtained on Nb, Nb–Zr, Nb–W, Nb–Mo, Nb–V, Nb–Fe, Nb–Ti, Nb–Ti–Cr, Nb–Ti–Mo, and Nb–Ti–V alloys exposed in high-temperature water and steam. Corrosion data are given for Nb–U alloys in air, CO_2, NaK, water, and steam. Techniques are being developed for the preparation and cladding of cermets containing 60 to 90 vol. % of fuel dispersed in metal matrices of Nb, Mo, Cr, and stainless steel. The gas-pressure-bonding process is being investigated as a method of fabricating fuel elements clad with Mo or Nb. The high-temperature irradiation behavior of dispersion fuel elements consisting of 24 wt.% UN and UC dispersed in stainless steel is being evaluated. Hot-pressing techniques are being used to investigate the kinetics and mechanism of solid-state bonding of metals by the application of heat and pressure. Methods of producing dense UC pellets by powder metallurgy are being investigated. Data are presented on the effect of carbon content and impurities on corrosion resistance of UC in 60°C water. The effects of carbon content on density and electrical resistivity of UC are reported. Fundamental studies are being made of the reaction of Nb with N_2, and the diffusion and terminal solubilities of N_2 in the metal. A U–Nb constitution study utilizing diffusion couples to establish the composition limits of the γ-phase immiscibility gap in the system is in progress. Data are presented on time-temperature relationship using induction heating on a UO_2–graphite sphere. The dissolution of 25 fuel pins in a Ni-o-nel dissolver by the Sulfex–Thorex process has demonstrated the necessity of solution annealing all weldments in order that the sever integranular attack be prevented. A Ti 75 A dissolver used for the dissolution of 25 fuel pins by the Darex–Thorex process underwent negligible attack except in areas around weldments in the vapor phase. The development of binary Ta alloys as container materials for LAMPRE applications is reported. The gas-pressure-bonding process is being in-

vestigated as a backup effort for the preparation of Zircaloy-2-clad compartmented flat-plate fuel elements containing UO_2 cores for the PWR Core-2. Uranium dioxide cores were coated with pyrolytic carbon by cracking of methane on UO_2 at 1880°F. Cores of UO_2 were coated with Cr deposited by vacuum evaporation. Fuel-element cores consisting of about 20 vol. % UO_2 particles dispersed uniformly in a densely sintered BeO matrix are being developed. A process for applying an impermeable BeO cladding to UO_2 particles is being investigated. A study is being made of potential carbon-transport, metal-oxidation, and metal-carburization problems which may be associated with an uncladd-graphite-moderated helium-cooled reactor system. Preparation of graphite–UO_2 pins was completed. The preparation of UO_2 ceramic pellets for in-pile testing was completed. (For preceding period see BMI-1346.) (W.L.H.)

21171 BMI-1370

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS ON THE DEVELOPMENT OF URANIUM CARBIDE-TYPE FUELS. Frank A. Rough and Walston Chubb, eds. Aug. 21, 1959. 17p. Contract W-7405-eng-92. $0.75(OTS).

It has been confirmed that uranium monocarbide can be prepared by reacting uranium metal powder with methane at about 650°C, and that sintered carbides of greater than 90% of theoretical density can be made. The cast density of carbides has been found to vary from 13.56 g/cm^3 for UC to 11.7 g/cm^3 for UC_2. The electrical resistivity of cast carbides has been found to vary from about 40 microhm-cm for UC to about 90 microhm-cm for UC_2. About 500 ppm of iron or silicon has been found to decrease the quality of arc-melted castings of uranium monocarbide. Oxygen reacts with molten carbide to produce metal and carbon monoxide. Nitrogen seems to react with molten carbide to displace carbon from the monocarbide and produce some dicarbide. Diffusion rates in the carbides have been found to be appreciable at 1600°C ($D = 3.6 \times 10^{-6}$ cm^2/sec) and very rapid at 1980°C ($D = 2.2 \times 10^{-6}$ cm^2/sec). The activation energy for diffusion in this system is very high (92,000 cal/mole). Additional studies are in progress to determine suitable chemical methods of preparing carbides from available raw materials, to develop techniques for making high-density compacts of carbide powder, to cast large shapes of carbide by melting techniques, to measure the mechanical and physical properties of cast uranium carbide and its alloys, to determine the chemical compatibility of carbides with various metals and reactor coolants, and to obtain information on the mechanism by which carbide-type compounds are damaged by fission fragments during neutron irradiation. (auth)

21172 BMI-1372

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS ON THE USE OF GAS-PRESSURE BONDING FOR FABRICATING LOW-COST CERAMIC, CERMET, AND DISPERSION FUELS. Stan J. Paprocki, ed. Aug. 25, 1959. 27p. Contract W-7405-eng-92. $1.00 (OTS).

Basic properties of several types and grades of commercial UO_2 have been determined. Compacting characteristics of these powders were evaluated with the objective of obtaining a minimum cold-pressed density of 70% of theoretical prior to gas-pressure bonding. Fused and special dense grades of UO_2 powders were compacted to a density of 85% of theoretical by use of a 50-tsi compacting pressure. Cold-pressed compacts were simultaneously clad and densified to a maximum density of 99.5% of theoretical. The UO_2 powders that were capable of being pressed to the highest cold-pressed density exhibited the least amount of densification during gas-pressure bonding. A small stainless steel-clad UO_2 flat-plate assembly was pressure bonded at 2100°F for 3 hr at 10,000 psi. Examination of this assembly indicates that it is feasible to prepare fuel assemblies of this type in a one-step operation by use of the gas-pressure-bonding process. (auth)

21173 BW-5406

Babcock and Wilcox Co. Research and Development Dept., Alliance, Ohio.

INVESTIGATION OF RESISTANCE TO HEAT FLOW THROUGH CLAD PLATES. Earl E. Coulter and D. L. Mayer. Apr. 26, 1951. Includes Appendix by William H. Moyer. 21p. For Westinghouse Electric Corp. [Atomic Power Div.] Subcontract 14-302. $3.30(ph), $2.40(mf) OTS.

The purpose of this investigation was to determine the heat flow resistance of the bond in B&W clad plate as compared to another type of clad plate referred to as "Type X". The test showed that the difference between the bonds was less than the accuracy of the testing method employed, and that both bonds were suitable for normal pressure vessel usage. (auth)

21174 CF-55-11-174

Oak Ridge National Lab., Tenn.

FRICTION CHARACTERISTICS OF SMALL DRAWN INCONEL TUBES BEFORE AND AFTER SERVICE IN A NaK HEAT EXCHANGER. J. L. Wantland. Nov. 29, 1955. Decl. July 16, 1959. 14p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

The friction characteristics of two small drawn Inconel tubes, such as those to be used in the ART fuel-to-NaK heat exchanger, were determined in the Reynolds modulus range of from 50,000 to 250,000. One of these tubes was a clean tube and the other had been in service for 1500 hours in an experimental fuel-to-NaK heat exchanger. Results of these tests indicate that service in the heat exchanger did not appreciably vary the friction characteristics of the tubes due to a possible change in surface roughness, the data obtained from either tube being correlated within ±2% by the empirical equation $f = 0.149/N_{Re}^{0.18}$ in the Reynolds modulus range tested. These tubes can essentially be considered to be smooth tubes, the friction factors averaging about 6% greater than would be predicted by $1/\sqrt{f} = -0.8 + 2 \log (N_{Re}\sqrt{f})$. Photomicrographs show that the inside surface characteristics of the Inconel tubes are essentially the same for a new clean tube, a hydrogen-fired tube, and a tube taken from a NaK heat exchanger. The surfaces appear to be irregular but without a consistent degree of roughness. (auth)

21175 CF-59-8-50

Oak Ridge National Lab., Tenn.

SECONDARY-SIDE WATER TREATMENT FOR CORROSION CONTROL IN ALUMINUM HEAT EXCHANGERS: PRACTICES AND RESULTS AT THE OAK RIDGE RESEARCH REACTOR. P. D. Neumann. Aug. 12, 1959. 19p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Standard water treatment practices have proven adequate for scale and corrosion control on the secondary side of the ORR pool-cooling heat exchanger. Corrosion rates measured on specimens exposed to secondary

water showed maximum corrosion rates of approximately 1 mpy during the first exposure period and these rates decreased during subsequent exposure. Examination of the heat exchanger tube bundle after 6 months and 13 months of operation showed only minor film formation and very little evidence of corrosion. (auth)

21176 CF-59-8-80

Oak Ridge National Lab., Tenn.

WELDED SEAL-RING VACUUM CLOSURES. C. Michelson. Aug. 21, 1959. 36p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

The development of bakeable high-vacuum flanges for the ORNL PIG Facility is reported. The general design approach for this type flange is to obtain a bakeable vacuum seal by first welding thin metal rings to a set of heavy metal flanges, and then edge-welding the rings together. This design allows the option of O-ring sealing for nonbaked operation. A number of flange designs are discussed together with fabrication, inspection, testing, and installation and maintenance information. (auth)

21177 DMIC-116

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

DESIGN INFORMATION ON 5Cr ALLOY STEELS FOR AIRCRAFT AND MISSILES. F. R. Morral, R. J. Favor, and W. P. Achbach. Aug. 28, 1959. 44p. Contract AF18(600)-1375. (PB-151072).

A summary is presented of design information pertinent to the use of the 5Cr-Mo-V (H-11 type) alloy steels in aircraft and missile applications. Heat treatment, melting practice, and corrosion protection are considered. Manufacturing problems such as machining, forming, and joining are also briefly discussed. Data on the elevated-temperature mechanical properties of these H-11 type steels have been collected and evaluated. (auth)

21178 DMIC-Memo-31

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

DRILLING HIGH-STRENGTH STEELS HEAT TREATED TO 330 TO 560 BRINELL HARDNESS. A. F. Gerds, Carl T. Olofson, and F. W. Boulger. Aug. 24, 1959. 16p.

Successful drilling of hardened steels requires adequate power, rigidity, and appropriate drills. Drilling speeds and feeds range from 7 to 40 ft/min. and 0.0005 to 0.005 in. per revolution, respectively. Feeds must be positive. Idling in the hole without cutting work hardens the steel below the drill point, making further drilling virtually impossible. Rigid setups between work and drill, and the use of short, heavy-duty drills are emphasized. These factors increase drill life and hole accuracy, and frequently allow the use of less expensive high-speed steel drills. A back-up plate is often important for added support, especially when drilling through holes. The composition and geometry of the drill have pronounced effects on successful drilling of high-strength steels, but the available information does not warrant specific recommendations on these two factors. The conditions and tools which were reported to be suitable for use with various workpieces are described. (auth)

21179 DMIC-Memo-34

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

FABRICATION OF PURE COLUMBIUM. W. D. Klopp and Webster Hodge. Sept. 11, 1959. 8p.

The fabrication of pure niobium is readily carried out cold with conventional tools. Precautions must be taken, when extreme-pressure processes are used, to prevent sticking by the use of very smooth die finishes and proper lubricants. Since the metal is rapidly contaminated by all common gases at elevated temperatures, welding operations must be performed in an atmosphere of helium or purified argon, and annealing operations in a high vacuum. Solid-solution alloys may be handled, in general, like pure niobium. (auth)

21180 DP-377

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

EROSION OF MAGNESIUM. Albert H. Peters. June 1959. 12p. Contract AT(07-2)-1. $0.50(OTS).

Specimens of a magnesium alloy containing 8 wt. % aluminum were eroded at a rate of 0.1 in./yr when exposed at 40°C to deionized water flowing at a velocity of 20 ft/sec. The rate of erosion was several times higher for specimens with lower concentrations of aluminum. (auth)

21181 HW-60433

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PREPARING ZIRCALOY-2 FOR AUTOCLAVE TESTING— THE PICKLING AND RINSING PROCESS. D. W. Shannon and B. Griggs. July 1, 1959. 82p. Contract W-31-109-Eng-52. $2.25(OTS).

A pickling and rinsing process has been developed to prepare the Zircaloy-2 PRTR fuel elements for autoclave corrosion testing. As background for this process the chemical and corrosion properties of Zircaloy-2 and the chemistry of the pickling process are outlined. The facilities, materials of construction, and pickling and rinsing procedures are discussed. Laboratory experiments relative to the pickling and rinsing process, materials of construction, and several alternative pickling processes are presented. (auth)

21182 MND-E-1699

Martin Co., Baltimore.

LOOP TESTING OF TYPE 304 STAINLESS STEEL MINIATURE HEAT EXCHANGERS. TASK I, PHASE 3. A. Wiegel and J. W. McGrew. Jan. 1959. 37p. Contract DA-44-009-ENG-3043. (AD-210950).

Three Type 304 stainless steel miniature heat exchangers were subjected to selected corrosive water conditions in a high pressure water loop. One exchanger failed by stress corrosion cracking after only 42 hours of service and another failed after 1085 hours. The third exchanger did not fail after a service period of 1890 hours. Stress corrosion cracking was found in the submerged portions of both the tubes and tube sheets of the two exchangers which failed. Cracking was observed in one unit at the tube-tube sheet junction exposed to the steam phase. The failures which were encountered were all due to transgranular stress corrosion cracking. Expanding the tubes at the tube-tube sheet junction was sufficient to avoid penetration by the corrosive environment. The tolerable limits of environmental oxygen and caustic were indicated to be quite low. A bimetallic miniature heat exchanger (MIN 7) which was tested along with MIN 1, 2, and 3 has not failed and will undergo further testing. Results for this unit will be reported at a later date. (auth)

21183 MND-E-2092

Martin Co. Nuclear Div., Baltimore.

LOOP TESTING OF STAINLESS STEEL AND BIMETALLIC MODEL HEAT EXCHANGERS. ERDL—TASK

1, PHASE 1. July 1959. 92p. Contract DA-44-009-ENG-3043.

Two sets of model configuration heat exchangers were dynamically tested with selected secondary water conditions in a high pressure water loop. Each set of the test units consisted of a steam generator and a superheater. One set was fabricated entirely of stainless steel, the other set was of bimetal construction with a stainless steel primary, and a low carbon steel secondary. A bimetal miniature heat exchanger, fabricated with the same configuration as the full-size models, was subjected to a static corrosion test in a loop bypass test section. The low carbon steel secondary water systems of the bimetal steam generator and superheater suffered considerable general corrosion and pitting. Severe cracking of the tube sheet and shell and the shell adjacent to the tube sheet caused the failure of the type 304 stainless steel superheater. Cracking was not found in the secondary side of any of the other four test vessels. Cracks resulting from fabrication of the tubing were found on the primary side of the miniature unit. (W.L.H.)

21184 NAA-SR-3887

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SODIUM REACTOR EXPERIMENT FUEL IRRADIATION EXPERIENCE. J. L. Ballif, B. R. Hayward, J. H. Walter, and C. C. Woolsey. Sept. 15, 1959. 38p. Contract AT-11-1-GEN-8. $1.00(OTS).

Nondestructive examinations of the unalloyed uranium fuel in the Sodium Reactor Experiment (SRE) showed no increase in cladding diameter after 850 Mwd/Ton calculated maximum burnup. Some clad stretching is evident at 950 Mwd/Ton. Destructive examinations at maximum burnups of 65, 105, 390, and 850 Mwd/Ton showed progressive irradiation-induced dimensional changes. Data showed maximum changes in diameter of 1.7%, in length of 2.9%, and in density of −2.6% for the highest burnup. Surface conditions indicated progressive roughening with increasing fuel material burnup level. All surface and dimensional characteristics appeared to be directly related to burnup. Some relationship was found between surface roughening and fuel element surface temperature. The SRE fuel element design appears to be performing well. Fuel element cladding examinations indicated no apparent change in ductility after exposure to surface temperatures of about 850°F, with subsequent cycling resulting from startup and shutdown of the reactor. (auth)

21185 NASA-TN-D-52

National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

THE RATE OF FATIGUE-CRACK PROPAGATION FOR TWO ALUMINUM ALLOYS UNDER COMPLETELY REVERSED LOADING. Walter Illg and Arthur J. McEvily, Jr. Oct. 1959. 20p.

A series of crack propagation tests of sheet specimens has been conducted under completely reversed loading at various stress levels up to 30 ksi. Differences between effects of the compression and tension parts of the cycles are discussed. Semiempirical equations are developed which permit calculation of crack growth. Results are compared with those from similar tests made at a minimum stress of 1 ksi. In both types of loading, the governing parameter was found to be related to the local stress at the crack tip. (auth)

21186 NASA-TN-D-79

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

HIGH-TEMPERATURE TENSILE PROPERTIES OF WROUGHT SINTERED TUNGSTEN. Paul F. Sikora and Robert W. Hall. Sept. 1959. 17p. $0.50(OTS).

Tensile tests at temperatures from 2500 to 4400°F were conducted on specimens fabricated from ½-inch-diam-swaged bars of commercially pure tungsten. Material from five different producers was evaluated. Although a decrease in ductility with increasing temperatures above 2500°F is characteristic of commercial tungsten, there remained an appreciable amount of ductility up to 4400°F. Ultimate tensile strengths and fracture ductility data are reported. (auth)

21187 NASA-TN-D-125

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

THERMAL-STRESS FATIGUE CRACKING OF TURBINE BUCKETS OPERATED AT 1700°F IN A TURBOJET ENGINE WITH FREQUENT STARTS AND STOPS. R. A. Signorelli, J. R. Johnston, and J. W. Weeton. Oct. 1959. 17p.

An investigation conducted to determine the effects of advanced-temperature operation on the thermal-stress fatigue resistance of nickel-base alloys SEL-1, B and B, Inconel 713, cast Udimet 500, and wrought Udimet 500 indicated that all of the materials tested developed thermal-stress fatigue cracks after short operating times in a J47 engine. Cracks occurred in some alloy groups after as few as 10 starts (6½ hr at rated-speed conditions) and in all groups after 28 starts (30 hr). Although the buckets were operated up to 63 hours after crack detection, only one fracture occurred during the test. (auth)

21188 NMI-1224

Nuclear Metals, Inc., Concord, Mass.

CAST HOLLOW FUEL RODS. E. M. Avallone, A. R. Kaufmann, and J. E. Roman. July 31, 1959. 17p. Contract AT(30-1)-1565. $3.30(ph), $2.40(mf) OTS.

The development of a method of producing an axial hole in a U fuel element completely clad with Zr is reported. (W.L.H.)

21189 NMI-2502

Nuclear Metals, Inc., Concord, Mass.

THE FABRICATION OF CLAD MASSIVE UO_2 FUEL ELEMENTS BY COEXTRUSION. Quarterly Report No. 1. F. S. Gardner, J. G. Hunt, and W. D. Munro. Sept. 15, 1959. 32p. Contract AT(30-1)-1565. $6.30(ph), $3.00(mf) OTS.

The fabrication of UO_2 rods by the multitemperature coextrusion process with the oxide heated to 2450°F and with reductions ranging from 2x to 9.6x is described. (W.L.H.)

21190 NMI-4377

Nuclear Metals, Inc., Concord, Mass.

EVALUATION OF ZIRCALOY-CLAD U−2 w/o Zr ALLOY TUBE NO. 28, EXTRUSION NO. 18388. D. F. Kaufman and R. G. Jenkins. Apr. 13, 1959. 39p. Contract AT(30-1)-1565, Sponsor Agreement No. 8-31. $6.30(ph), $3.00(mf) OTS.

The evaluation data presented in this report show that Tube No. 28 meets irradiation specifications in all characteristics except maximum clad thickness both in taper regions (+1.0 mil OD and +1.4 mil ID out of specification which restricts taper clad thickness to 16 mils

maximum) and above the core (+0.2 mil OD above the maximum specification limit of 18 mils), and final straightness ($\frac{1}{64}$ inch out of specification which restricts the maximum bow to $\frac{1}{8}$ inch). Although no sharply defined pits or scratches deeper than 2 mils were observed, some smoothly contoured depressions less than 3 mils deep were found. If the cladding thickness does not follow the contour of the depression, but is actually decreased by an amount equal to the depth of the depression, the minimum clad thickness is at least 11.3 mils. This value, although 0.7 mil below the minimum specification for normal cladding, is still 1.3 mils above the minimum specification for the thickness of cladding remaining below pits or scratches (10 mils). None of the above deviations from specification are considered serious by du Pont. Tube No. 28 is representative of a lot of nine tubes and is considered suitable for irradiation at Savannah River. (auth)

21191 NMI-4378

Nuclear Metals, Inc., Concord, Mass.

EVALUATION OF ZIRCALOY-CLAD U–2 w/o Zr ALLOY TUBE NO. 32, EXTRUSION NO. 18392. D. F. Kaufman and R. G. Jenkins. Apr. 13, 1959. 37p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $6.30(ph), $3.00(mf) OTS.

The evaluation data presented in this report show that Tube No. 32 meets irradiation specifications in all characteristics except maximum clad thickness in taper regions (+0.5 mil OD, and +1.3 mils ID out of specification which restricts taper clad thickness to 16 mils maximum) and final straightness ($\frac{1}{16}$ inch out of specification which restricts the maximum bow to $\frac{1}{8}$ inch). Although no sharply defined pits or scratches deeper than 2 mils were observed, some smoothly contoured depressions less than 3 mils deep were found. If the cladding thickness does not follow the contour of the depression, but is actually decreased by an amount equal to the depth of the depression, the minimum clad thickness is at least 11.4 mils. This value, although 0.6 mil below the minimum specification for normal cladding, is still 1.4 mils above the minimum specification for the thickness of cladding remaining below pits or scratches (10 mils). None of the above deviations from specification are considered serious by du Pont. Tube No. 32 is representative of a lot of nine tubes and is considered suitable for irradiation at Savannah River. (auth)

21192 NMI-4388

Nuclear Metals, Inc., Concord, Mass.

CORROSION BEHAVIOR OF FUEL ELEMENTS WITH U–2 w/o Zr CORE CLAD WITH ZIRCALOY-2. Status Report. S. Isserow. Apr. 30, 1959. 40p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $7.80 (ph), $3.30(mf) OTS.

Further corrosion tests have been performed on sections from power tubes with a U–2 wt.% Zr core and 15-mil Zircaloy-2 cladding. Emphasis is on tests with a gross defect inserted in the outer cladding. These tests include cooling to simulate reactor shut-down at fixed intervals after attainment of a set level of corrosion at 660°F (349°C). Results presented for such tests in water and steam show that the consequences of an in-pile failure are not likely to be disastrous either in terms of uranium release or physical damage to the tube. As-extruded material is attacked less rapidly by 660°F (349°C) water than heat treated; the pattern of corrosion and damage is also affected by heat treatment. Quantitative results for heat-treated material are sensitive to the cooling rate and to the location of the defect. Results are also presented for other corrosion tests, notably tests of tube sections with their transversely cut faces exposed. Such tests were applied to various questions such as the effect of hydrogen concentration during the corrosion test or the effect of modified heat treatments on the core alloy. (auth)

21193 NMI-4390

Nuclear Metals, Inc., Concord, Mass.

TWISTED RIBBON FUEL ELEMENT. Status Report to E. I. du Pont de Nemours and Company. A. R. Kaufmann. June 10, 1959. 9p. For E. I. du Pont de Nemours and Co. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $1.80(ph), $1.80(mf) OTS.

Fabrication feasibility was investigated for Zr-clad U ribbon $\frac{1}{4}$ in. by $\frac{1}{8}$ in. cross section with $\frac{1}{2}$ turn per foot. It appears that such ribbons can be produced. However, further refinements are necessary if the element is to meet strict specifications. (J.R.D.)

21194 NMI-4391

Nuclear Metals, Inc., Concord, Mass.

EFFECTS OF THERMAL CYCLING ON AN INTEGRALLY COEXTRUDED TUBULAR FUEL ELEMENT OF U-2 w/o Zr CLAD WITH ZIRCALOY-2. Final Report to E. I. Du Pont de Nemours and Company. R. G. Jenkins. Aug. 3, 1959. 26p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $4.80(ph), $2.70(mf) OTS.

Data are presented which show that 200 thermal cycles between baths at 500 to 100°C caused no significant changes in the dimensions, straightness or ultrasonic bond strength of a prototype, integrally coextruded, tubular fuel element of U–2 wt.% Zr clad with 15 mils of Zircaloy-2. The cycles were conducted so that 10 to 15 seconds after the tube entered the low temperature bath, estimated temperature differences of 150 to 280°C were obtained between the mid-wall and the surface of the tube. (auth)

21195 NMI-4394

Nuclear Metals, Inc., Concord, Mass.

POWER REACTOR PROGRAM; PROGRESS REPORT TO E. I. DU PONT DE NEMOURS AND COMPANY FOR THE PERIOD MAY 1, 1959 THROUGH MAY 31, 1959. S. Isserow, D. F. Kaufman, A. M. Huntress, W. L. Larson, and W. J. Richmond. Aug. 31, 1959. 26p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $4.80(ph), $2.70(mf) OTS.

An analysis for U distribution in two prototype driver tubes, one in the as-extruded condition, the other in the extruded and drawn condition, indicates that satisfactory fuel uniformity can be obtained in tubes in either condition. Six Zircaloy-clad tubes of unalloyed U were extruded. All tubes appeared satisfactory except one on which die pickup and scoring of the Cu jacket occurred. After preliminary cropping and radiography, three of the six tubes were beta-treated in their Cu extrusion jackets by immersion in a salt bath for 10-min at 1345°F. When the Cu was pickled from these tubes, breakthrough of the core was observed on the inside of two of the three, near the end seal regions. The causes of inside breakthrough and clad thickness fluctuation are not immediately apparent. Work has started on a program to fabricate power tubes having U alloy cores, with the objective of obtaining a core composition with a better irradiation performance than that of U–2 wt.% Zr. In the initial phases, the core compositions will be

U–1.5 wt. % Mo, U–1 wt. % Si, U–0.5 wt. % Al, and U–0.2 wt.% Al. (W.L.H.)

21196 NMI-4395

Nuclear Metals, Inc., Concord, Mass.

POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period June 1, 1959 through June 30, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, and A. M. Huntress. Sept. 16, 1959. 18p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $3.30(ph), $2.40 (mf) OTS.

A program on reduced scale tubes was initiated to gain an understanding of the factors leading to the clad thinning at flowshapes and to fluctuations generally observed in the inside clad thickness in a lot of five full-sized unalloyed uranium tubes. The program aimed at developing power tubes with uranium-rich alloy cores other than U–2 wt. % Zr is well under way. Sound castings close to desired composition were obtained in the systems U–0.2 wt. % Al, U–0.5 wt. % Al, U–1 wt. % Si and U–1.5 wt. % Mo. (For preceding period see NMI-4394.) (W.D.M.)

21197 NOR-59-227

Northrop Aircraft, Inc., Hawthorne, Calif.

PROGRAM FOR THE DEVELOPMENT OF EXTRUDED BERYLLIUM SHAPES. Interim Engineering Report No. 3 [for] December 1, 1958 through February 28, 1959. 54p. Contract AF33(600)-36931. (AD-216732).

The work accomplished during this period involved the transition from round rod to bare extruded beryllium channel of the Z-1 size and configuration. The feasibility of processing bare beryllium extrusions of aircraft quality was shown and was found comparable in applicable respects to the aluminum alloy counterparts. (J.E.D.)

21198 NP-7879

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE INITIAL STAGES OF PLASTIC DEFORMATION IN ALUMINUM AND COPPER. Technical Report No. 1. A. R. Rosenfield and B. L. Averbach. Aug. 31, 1959. 49p. Contract Nonr-1841(35).

The early stages of plastic flow and microcreep in aluminum and copper have been studied with a strain sensitivity of 2×10^{-6} at temperatures ranging from 25 (77°F) to −196°C (−321°F) as a function of composition and substructure. The temperature dependence of the elastic limit in both materials is interpreted as arising from a thermal activation of stacking faults under stress, and this model results in values of 65 and 210 ergs/cm^2 for the stacking fault energies of copper and aluminum, respectively. The effects of impurities differ in the two materials and have been ascribed to the presence of precipitates in aluminum and solid solution formation in the case of copper. The jog formation energy in both materials was measured from an analysis of the stress-strain curve on unloading, giving a value of 0.49 ev for copper and 0.21 ev for aluminum. (auth)

21199 NP-7885

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

FIELD EMISSION MICROSCOPY OF METAL CRYSTAL NUCLEATION. Final Report on OXIDATION, VAPOR NUCLEATION AND SURFACE DIFFUSION OF METALS AND ALLOYS. K. L. Moazed and G. M. Pound. Sept. 15, 1959. 114p. Contract AF18(600)-1572.

Techniques were developed for a field emission microscopic investigation of the heterogeneous nucleation of metal vapors on metallic substrates. Quantitative measurements were made for the nucleation of silver on tungsten. Nucleation was observed to occur when the population of adsorbed silver atoms reached a critical value. There were definite preferred sites on the substrate surface where nucleation occurred. An extension of the present theory of nucleation was made so that the present experimental case could be treated. Qualitative observations were made on the mobility of silver on tungsten. The mobility of the silver deposit was found to be anisotropic on the emitter tip. Qualitative observations were also made on the evaporation and desorption of silver from a tungsten emitter tip. Observations of the adsorption and desorption of residual gases on the emitter tip were also made. (auth)

21200 NP-7902

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

BIBLIOGRAPHY ON URANIUM ALLOYS WITH BINARY PHASE DIAGRAMS AND SELECTED DATA ON PROPERTIES. Helen C. Friedemann and Henry H. Hausner. [1959]. 70p.

Available from Sylvania-Corning Nuclear Corp. $1.00.

This bibliography contains 470 references on U alloys. Also included are U binary phase diagrams and data on U alloys. (W.L.H.)

21201 NRL-5341

Naval Research Lab., Washington, D. C.

THE STRUCTURE OF ALUMINUM–SILICON ALLOYS. R. A. Meussner. May 19, 1959. 24p. Project NR 511-000.

The microstructures and the morphologies of the phases of unmodified Al–Si alloys were examined through the use of special etchants and a chemical extraction technique. X-ray-diffraction studies were used to confirm the metallographic observations. Although the dendritic form of the primary α phase was found to be unaltered by changes in the growth conditions, the form of the primary Si phase was not unaffected by these changes. The usual complex idiomorphic form of the Si phase was transformed to the dendritic form when growth occurred in a supersaturated liquid. Eutectic Si plates, which have been observed to grow from primary Si particles, dominate the eutectic transformation and, by branching, restrict the growth of the eutectic α phase. This mode of solidification produces fine eutectic colonies in this abnormal eutectic structure. (auth)

21202 NRL-5346

Naval Research Lab., Washington, D. C.

SOLIDIFICATION OF THE ALUMINUM–SILICON EUTECTIC. R. A. Meussner. May 27, 1959. 13p. Project NR 511-000.

The eutectic solidification process in aluminum–silicon alloys has been examined through a metallographic study of slowly cooled and quenched specimens. The use of suitable etchants to delineate the structures of the Si and α phases and the examination of extracted particles of Si have shown that the abnormal Al–Si eutectic structure is the result of the great disparity in the nucleation and growth characteristics of the two phases. The eutectic Si not only nucleates readily, but it grows rapidly into a branched-plate structure. The nucleation of the α phase, requiring a high supersaturation, is retarded and, as a con-

sequence, this phase exerts very little control in the solidification process. Thermal data, showing the relative effectiveness of the two primary phases in limiting the undercooling preceding the eutectic, support these observations. (auth)

21203 NYO-1330

Mallinckrodt Chemical Works, St. Louis.

THE CORROSION RESISTANCE OF SEVERAL ALLOYS IN AN HF–H_2O ATMOSPHERE AT HIGH TEMPERATURES. C. F. Ritchie and E. K. Teter. Jan. 22, 1952. Decl. June 19, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

Tests indicate that of the various alloys tested for corrosion resistance when exposed to an HF–H_2O atmosphere at 1070°F, the Cr–Ni alloys, as a group, give the best corrosion resistance where strength at high temperature is desired. Other alloys have given excellent results but the lack of strength at the higher temperatures or cost, is against their use in production equipment. (auth)

21204 ORNL-1955

Oak Ridge National Lab., Tenn.

FABRICATION OF HEAT EXCHANGERS AND RADIATORS FOR HIGH TEMPERATURE REACTOR APPLICATIONS. Period Covered: February 1955–April 1955. P. Patriarca, G. M. Slaughter, W. D. Manly, and R. L. Heestand. July 5, 1956. Decl. July 16, 1959. 74p. Contract W-7405-eng-26. $10.80(ph), $3.90(mf) OTS.

Two 500-kw fused-fluoride-to-NaK heat exchangers, two 500-kw NaK-to-air radiators, and a 20-tube high-velocity heat exchanger were fabricated for a heat-exchanger development program. A construction procedure, utilizing both inert-arc-welding and high-temperature dry-hydrogen brazing, was used successfully on all of the units. The tube-to-header joints were welded and back-brazed; the manifold joints were inert-arc-welded with full penetration; and the tube-to-fin joints were brazed. A detailed description of the fabrication of each type of component is discussed and a cost analysis of the 500-kw units is presented. (auth)

21205 ORNL-2264

Oak Ridge National Lab., Tenn.

INCONEL AS A STRUCTURAL MATERIAL FOR A HIGH-TEMPERATURE FUSED-SALT REACTOR. J. R. Weir, Jr., D. A. Douglas, and W. D. Manly. June 18, 1957. Decl. July 30, 1959. 78p. Contract W-7405-eng-26. $12.30(ph), $4.50(mf) OTS.

The use of a circulating-fuel type of nuclear reactor as an energy source in aircraft propulsion systems imposes upon the structural material metallurgical restrictions which limit the applicability of certain types of alloys. The general factors which must be considered in the selection of an alloy for this application are corrosion resistance, fabricability, nuclear properties, radiation damage, and elevated-temperature strength. The importance of each of these topics is pointed out, and it is shown that the selection of Inconel as a structural material was based on these criteria. (auth)

21206 SEP-252

Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.

THE SELF-DIFFUSION OF NIOBIUM—III. Final Progress Report [for] July 1, 1958 to January 1, 1959. R. Resnick, L. S. Castleman, and L. Seigle. Mar. 30, 1959. 14p. Project No. 1916. Contract AT(30-1)-2102. $3.30(ph), $2.40(mf) OTS.

The self-diffusion coefficient of niobium was measured over the temperature range 1535 to 2120°C, using the radioactive isotope Nb^{95} as the tracer. The data for the temperature dependence of the self-diffusion coefficient are best fitted by the equation $D = (12.4 \pm 0.2) \exp [(-105{,}000 \pm 3000)/RT]\ cm^2/sec$. (auth)

21207 SEP-253

Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.

FUNDAMENTALS OF DIFFUSIONAL BONDING—IV. Fourth Annual Progress Report [for] July 1, 1958 through June 30, 1959. L. S. Castleman and L. Seigle. June 30, 1959. 24p. Contract AT(30-1)-2102. $0.75 (OTS).

Investigation of interdiffusion in the aluminum–uranium system and of the effects of applied pressure on such systems was about completed. The growth kinetics of the UAl_3 phase were determined at 400 to 600°C and at pressures of 1/4, 5, and 10 tsi. The origin of the macroscopic defects occurring in the UAl_3 layer during interdiffusion was clarified. The solubility range of UAl_3 was determined by a nuclear track emulsion technique to be about 2.6 at. % uranium. Exploratory runs were made with incremental diffusion couples of aluminum vs. UAl_3 and of UAl_3 vs. uranium disks to determine the growth rates of the UAl_4 and UAl_3 phases. A theoretical estimate was made of the importance of pressure-induced shifts in equilibrium concentrations in intermetallic layer growth in the aluminum–uranium and aluminum–nickel systems. (For preceding period see SEP-251.) (auth)

21208 WADC-TR-53-193(Pt. 3)

North Carolina State Coll., Raleigh.

VIBRATORY COMPACTING OF METAL AND CERAMIC POWDERS. Period covered: July 2, 1954 to July 2, 1955. W. C. Bell and J. R. Hart. Apr. 1954. 54p. Project title: CERAMIC AND CERMET MATERIALS. Contract AF33(616)-73. (AD-93395).

This investigation has been primarily concerned with the influence of particle size distribution on the sintering characteristics and physical properties of alumina, 15 Ni–85 TiC and 30 Cr–70 Al_2O_3 compositions. It has also been concerned with the application of vibratory, impact and hydrostatic forces in the forming of these compositions from powders. Difficulty was encountered in the sintering of compositions containing substantial amounts of coarse powders. The use of MgO as a mineralizer was found to be of considerable help in the sintering of the Al_2O_3 compositions. In every case, the use of a coarse particle fraction was found to reduce sintering shrinkage, but it also appeared to reduce the physical strength. There are strong indications in the most recent results obtained with the Al_2O_3 compositions, however, that this apparent inferiority in strength in the coarse-containing compositions is not necessarily an inherent property of coarse-containing compositions but is more probably due to incorrect sintering techniques. Results are reported for a wide number of particle size distributions and sintering treatments. The use of vibratory and impact forces in the forming of small, intricate shapes is also reported. (auth)

21209 WADC-TR-57-757

Pennsylvania State Univ., University Park.

CREEP DEFORMATION IN A SINGLE RIVETED STRUCTURAL JOINT UNDER AXIAL TENSION. [Period covered] March 1957 to December 1957. Joseph Marin. Dec. 1957. 12p. Project title: MATERIALS AND EVALUATION TECHNIQUES. Task title:

FATIGUE AND CREEP OF MATERIALS. Contract AF33(616)-2729. (AD-216712).

A review and study of the literature shows that efforts to determine the creep of riveted joints have been confined primarily to experimental investigations on the over-all creep in various types of riveted joints. Little attention has been given to the theoretical prediction of the creep deformation of a riveted joint from the basic simple tension creep strain-stress relation for the material. A procedure for theoretically predicting the creep deformation of a simple riveted joint is outlined. This procedure attempts to consider the creep of the component parts in a riveted joint. (auth)

21210 WADC-TR-59-29(Pt. I)
Brush Beryllium Co., Cleveland.
AN INVESTIGATION OF INTERMETALLIC COMPOUNDS FOR VERY HIGH TEMPERATURE APPLICATIONS. [Period covered]: March 13, 1956 to March 12, 1957. Robert M. Paine, A. James Stonehouse, and Wallace W. Beaver. Feb. 1959. 246p. Project No. 3104. USAF Delivery Order 33(616)-56-12.

Intermetallic compounds from thirty-five binary metallic systems were prepared, fabricated into oxidation-test specimens, and tested for oxidation resistance in dry air at 2300°F. Only high-melting (above 2550°F) compounds were studied. These included aluminides, beryllides, silicides, germanides, and zirconides, as well as numerous miscellaneous compounds. The intermetallic compounds or compositions which are shown to have sufficient oxidation resistance at 2300°F to be potentially useful at this temperature include $NbAl_3$, $TaAl_3$, $CrBe_2$, $MoBe_{12}$, Nb_2Be_{17}, $NbBe_{12}$, $TaBe_2$, Ta_2Be_{17}, $TaBe_{12}$, $TiBe_2$, $TiBe_{12}$, WBe_2, $ZrBe_{13}$, Zr_2Be_{17}, Cr_3Si, Ti_5Si_3, TiSi, $TiSi_2$, and $TaCr_2$. (auth)

21211 WAL-TR-405.21/1
Watertown Arsenal Lab., Mass.
TITANIUM–6% ALUMINUM–4% VANADIUM ALLOY: EFFECTS OF SPONGE PURITY, ALUMINUM CONTENT AND HEAT TREATMENT. L. S. Croan, F. J. Rizzitano, and W. L. Warner. Sept. 1959. 43p. DA Project 5A12-15-003. (PB-151995). $1.25(OTS).

An investigation was undertaken to determine the heat treating characteristics of the 5%Al–4%V titanium alloy, the solution and aging temperatures for optimum strength properties, and the effect of varying the aluminum and the interstitial contents on the heat treatment for optimum strength. The study involved the 6%Al–4%V titanium alloy made with three hardness levels of sponge (140, 160, 180 BHN) and three levels of aluminum (6%, 7%, 8%) made with the 140 BHN sponge. A fourth alloy of interest, 5%Al–3%FeCr–3%FeMo (140 BHN sponge) was included in the study. (auth)

21212 WAPD-CDA(AD)-466
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. DEPOSITION OF CORROSION PRODUCTS UNDER IRRADIATION VAN DE GRAAFF STUDY. Interim Report No. 4. G. P. Simon. [Oct. 1958]. 26p. $4.80(ph), $2.70(mf) OTS.

In order to determine what variables are involved in the phenomenon of preferential deposition of corrosion products on fuel element surfaces, Van de Graaff studies were initiated. Studies of the effect of high pH and oxygen on the release and deposition of corrosion products from carbon steel are presented. Results on the effect of added salts on deposition, and the results of a preliminary attempt to determine whether the fractional deposition of available corrosion product iron is dependent on the concentration of corrosion products in the water are reported. (W.L.H.)

21213 WAPD-TM-80
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
INVESTIGATIONS ON STAINLESS STEEL-AND TITANIUM-BASE DISPERSIONS. E. S. Byron, L. B. Prus, and S. W. Porembka. Oct. 1957. Decl. June 24, 1959. 65p. Contract NObs-67500. $10.80(ph), $3.90(mf) OTS.

The fabrication, structure, and mechanical properties of stainless steel- and titanium-base dispersions were investigated. Dispersants studied included both natural and enriched boron, boron carbide, and titanium diboride and the rare earth oxides Gd_2O_3 and Eu_2O_3. The blended powders were consolidated by a hot extrusion technique which resulted in good densities near theoretical density in the titanium-base materials. Both round and cruciform shape extrusions were investigated. Study included tests to determine mechanical properties of the dispersions, corrosion resistance, and the effects of irradiation. (auth)

21214 AEC-tr-3764
LIQUID FISSION MATERIALS. [PART] I. Th. van der Plas. Translated for Oak Ridge National Lab. from RCN Bull. 2, 142-6(1958). 16p. $3.30(ph), $2.40(mf) JCL.

A review of the general types of fluid reactor fuels is presented. In addition, some of the principal nonmechanical problems to be solved in the development of fluid fuels are discussed. Solutions to these problems are not presented. Liquid metals, molten salts, and solutions in water are examined. (J.R.D.)

21215 AEC-tr-3809
ON THE ELECTRONIC STRUCTURE OF THE TRANSITION METALS, THEIR ALLOYS AND THE HEAVY METALS. J. Friedel. Translated from J. phys. radium 19, 573-81(1958). 17p. $3.30(ph), $2.40(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15614.

21216 AEC-tr-3844
DILATOMETRIC STUDY OF THE ZIRCONIUM/HYDROGEN SYSTEM. Lucien Espagno, Pierre Azou, and Paul Bastien. Translated for Los Alamos Scientific Lab. from Compt. rend. 247, 1199-1201(1958). 4p. $1.80(ph), $1.80(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1977.

21217 AEC-tr-3846
VARIATIONS IN LENGTH AND DENSITY ACCOMPANYING THE ABSORPTION OF HYDROGEN BY ZIRCONIUM. Lucien Espagno, Pierre Azou, and Paul Bastien. Translated for Los Alamos Scientific Lab. from Compt. rend. 247, 83-6(1958). 3p. $1.80(ph), $1.80(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13953.

21218
MECHANISMS AND SOME THEORETICAL ASPECTS OF STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS. Corrosion 15, No. 9, 103, 106, 108, 110(1959) Sept.

After reviewing briefly the generally accepted causes of stress corrosion cracking of stainless steels, design of heat exchangers intended for use with chloride containing waters is considered. Conditions causing stress corrosion cracking make tube-side cooling better than shell side, favor designs eliminating stagnation and make mandatory operation resulting in full water boxes. Velocity in excess of 5 fps is recommended. Insulation containing chlorides should be protected from moisture and water temperatures kept as low as possible. Good aeration is necessary and recirculating waters should contain no chromates or other oxidizing compounds. While pH is not critical, this does not mean that pH in concentration cell anolytes is not important. Theoretical considerations involved in the stress corrosion cracking phenomenon are considered. Plastic deformation, which results in the accumulation of stresses at barriers along a slip plane, is viewed as a precedent to cracking. Nickel, among alloy constituents, is seen as beneficial in preventing cracking, and the reasons for this are suggested as an avenue of fruitful investigation. The nature of the corrosion phenomenon, involving such complex factors as films, adsorption effects, and electrical double layers are mentioned as areas where more study would be rewarding. Possibility of thermal or electrochemical concentration of chlorides must be designed out, cleaned out, or kept out of industrial cooling water systems. (auth)

21219

CORROSION INHIBITORS FOR CARBON TETRACHLORIDE–WATER VAPOR ATMOSPHERES. K. W. Calkins (Dow Chemical Co., Denver) and R. W. Hawley (Dow Chemical Co., Midland, Mich.). Corrosion 15, 447t-8t (1959) Sept.

The use of various inhibitors for the prevention of mild steel corrosion in a system of carbon tetrachloride and water vapor was investigated. An attempt also was made to establish a corrosion mechanism. Of the 48 inhibitors tested, 2-aminoethanol appeared to be the most effective. It was found that 0.4% by weight of 2-aminoethanol in carbon tetrachloride decreased the corrosion rate of mild steel in a carbon tetrachloride-water vapor atmosphere by 99%. The next most effective inhibitor decreased the rate by about 95%. (auth)

21220

ALUMINUM ALLOYS. Ralph L. Horst, Jr. and Frank B. Murphy (Aluminum Co. of America, [Pittsburgh]). Ind. Eng. Chem. 51, 1157-60(1959) Sept.

New products and uses of aluminum alloys in different industries are discussed. (C.J.G.)

21221

IRON, CARBON STEEL, AND ALLOY STEEL. R. W. Vanderbeck and E. H. Phelps (United States Steel Corp., Monroeville, Penna.). Ind. Eng. Chem. 51, 1178-84 (1959) Sept.

New production methods and alloying techniques for increasing corrosion resistance in carbon and low-alloy steels and iron alloys are presented. Welding processes and mechanical properties of these alloys are given. (C.J.G.)

21222

LEAD AND ITS ALLOYS. Edward J. Mullarkey (Lead Industries Assn.) Ind. Eng. Chem. 51, 1185-9(1959) Sept.

The use of lead and lead alloys is discussed relative to annealing behavior, mechanical properties, corrosion resistance, and use in shielding. (C.J.G.)

21223

LESS COMMON METALS. E. M. Sherwood (Battelle Memorial Inst., Columbus, Ohio.). Ind. Eng. Chem. 51, 1190-6(1959) Sept.

Methods of production and chemical, physical, and metallurgical properties are discussed for chromium, hafnium, molybdenum, niobium, rhenium, tantalum, tungsten, and zirconium. (C.J.G.)

21224

NICKEL AND HIGH-NICKEL ALLOYS. A. J. Marron (International Nickel Co.). Ind. Eng. Chem. 51, 1197-1203(1959) Sept.

Processing methods, uses, and mechanical, physical, and metallurgical properties are discussed for nickel and high-nickel alloys. (C.J.G.)

21225

STAINLESS STEELS AND OTHER FERROUS ALLOYS. W. A. Luce (Duriron Co., Inc.). Ind. Eng. Chem. 51, 1215-22(1959) Sept.

The use, corrosion, mechanical and physical properties, welding methods, and production processes for stainless steels and ferrous alloys are presented. (C.J.G.)

21226

TITANIUM. Howard B. Bomberger (Crucible Steel Co. of America, Pittsburgh). Ind. Eng. Chem. 51, 1228-30 (1959) Sept.

The industrial uses and mechanical and chemical properties of titanium and titanium alloys are discussed. (C.J.G.)

21227

AN INVESTIGATION OF THE DIFFUSION OF SILICON IN CERTAIN TRANSITION METALS. G. V. Samsonov and M. S. Koval'chenko (Inst. of Metalloceramics and Special Alloys, Academy of Sciences, Kiev). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 3, 62-7(1959) Mar. (In Russian)

The results of an investigation of the diffusion of silicon in Ti, Ta, Fe, and Mo are reported. An equation describing the relative change of weight of samples at a given temperature and saturation time is derived. The electrical resistance and critical pressure of silicic layers were measured. The results of measurements of layer thicknesses, phase layers, and microhardness are tabulated. The activation energy and constants for the change of the diffusion coefficient with temperature are also tabulated. (auth)

21228

THE EFFECT OF A BRITTLE CASE ON THE NOTCHED IMPACT TRANSITION OF UNIRRADIATED AND IRRADIATED STEEL. D. Hull and I. L. Mogford (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 4, 230-3(1959) July.

Notched impact specimens of En2 steel with a brittle layer on the outside, produced by nitriding were tested after a neutron irradiation of 8×10^{17} neutrons cm^{-2}, and the results compared with specimens without the brittle layer and unirradiated. In this way it is possible to divide the energy absorbed in fracture into the energy required to form a fast running crack, and the energy required to propagate this crack. The transition curve of the specimens with a brittle layer is very sharp. Irradiation doses of up to 1.49×10^{19} neutrons cm^{-2} were

used to determine the effect of irradiation on the increase in transition temperature. (auth)

21229

FOR HIGH TEMPERATURE PROTECTION — NEW CERAMIC COATINGS. Nuclear Energy Engr. 13, 448-9, 454(1959) Sept.

The compositions are given of promising coatings to be used in the protection of low-carbon steel at temperatures up to 1200°F. Frits, in which various oxides were substituted for B_2O_3, were designed and smelted. The most successful oxides were $Zn_3(PO_4)_2$ and $Ca_3(PO_4)_2$. Coatings which contain cerium oxide or both cerium oxide and chromic oxide as a refractory addition show the best results. (C.J.G.)

21230

PROBLEMS FOR NON-FERROUS METALLURGY IN THE COMING SEVEN YEARS. I. A. Strigin. Tsvetnye Metal. No. 1, 1-7(1959).

The expansion in the production of non-ferrous metals in the Soviet Union is outlined and discussed. The production increases planned for mining and ore processing are described. (J.S.R.)

21231

PROSPECTS FOR THE DEVELOPMENT OF THE NON-FERROUS METALS WORKING INDUSTRY. M. F. Bazhenov. Tsvetnye Metal. No. 1, 8-10(1959).

A brief survey is presented on the possible future demands on the non-ferrous metals industry, and the steps being taken to meet these demands are indicated. Possible improvements in the production techniques are discussed. (J.S.R.)

21232

PRODUCTION OF METALLIC YTTRIUM. L. A. Izhvanov and N. P. Vershinin. Tsvetnye Metal. No. 1, 44-7(1959).

The difficulties in the production of pure yttrium salts to be used in the production of the metal are reviewed. The thermal reduction of yttrium fluoride with distilled metallic calcium is described. The fluoride is prepared from the oxide by reaction with hydrofluoric acid. The fluoride is dried, calcined, and reacted with calcium turning in a tantalum crucible in an argon atmosphere. Yttrium of 98.85% purity is obtained with calcium impurities of 0.035%. The outer layers of the ingot are contaminated with tantalum. The best results are obtained when the charge in the crucible is compressed at 10 kg/cm^2. The yttrium is recovered from the slag by treating with concentrated sulfuric acid, leaching with water, and extraction of the yttrium as the oxalate. (J.S.R.)

21233

YTTRIUM AND ITS ALLOYS. Ye. M. Savitskii and V. F. Terekhova. Tsvetnye Metal. No. 1, 48-53(1959).

The microstructure and properties of yttrium and its alloys and the reaction and influence of the element on alloy properties were investigated. The microstructure of yttrium is characterized by inclusions of a second phase, both at the grain boundaries and within grains. Yttrium completely dissolves in cerium, and it forms eutectic mixtures with aluminum, iron, and copper. In alloys with chromium, titanium, and zirconium, it does not dissolve in large quantities, and there are peritectoid reactions over small concentration ranges and immiscibility in the solid state at higher yttrium concentrations. Yttrium is practically immiscible with vanadium, niobium, tantalum, and molybdenum. The addition of 0.1 to 0.2% yttrium refines the grain of the metals studied with the exception of aluminum and magnesium, with which the opposite effect is discussed. It has a deoxidizing and inoculating effect on all the alloys and a hardening effect with aluminum and magnesium. The microstructure of the alloys is pictured. (J.S.R.)

21234

DEVELOPMENT OF A SYSTEM FOR AUTOMATIC CONTROL OF THE MAGNESIUM-THERMIC TITANIUM REDUCTION PROCESS. A. G. Arkad'yev, V. A. P'yankov, Kh. L. Strelets, and G. B. Forsblom. Tsvetnye Metal. No. 1, 53-62(1959).

Studies on the possible automation of the magnesium-thermal reduction process for the production of titanium are reported. A determination of the temperature distribution in the reaction vessel showed that at a given time the temperatures were uniform within 15 to 20°C, but during the process the maximum temperature varies. It was concluded that an automatic process based on the control of the maximum temperature was possible. The system developed is outlined, and results obtained in pilot-plant operation are given. (J.S.R.)

21235

USE AND PROPERTIES OF NIOBIUM. G. V. Zakharova, I. A. Popov, L. P. Zhorova, and G. V. Kurganov. Tsvetnye Metal. No. 1, 73-9(1959).

An investigation on the mechanical properties of niobium at ambient and high temperatures was made. The values obtained for tensile strength, yield-point strength, elongation, and hardness are tabulated for cast, forged, and recrystallized metal. It was found that the tensile strength, yield point strength, and hardness increases with increasing oxygen content, but the elongation decreases. (J.S.R.)

21236

ENAMELLING OF ALUMINIUM. K. P. Azarov and V. Ye. Gorbatenko. Tsvetnye Metal. No. 1, 79-82 (1959).

Seven phosphate enamels were tested to determine their suitability for coating aluminum. The aluminum surface was degreased, treated with thiourea-containing sulfuric acid, and oxidized with a chromium sulfate-sodium hydroxide solution. The specimens were then heated and enameled by dipping, both treatments being repeated. Two of the enamels gave coatings of satisfactory appearance, acid resistance, and adhesion. The compositions of these enamels were 2.7% Li_2O, 10.9% Na_2O, 7.4% NaF, 18.7% Al_2O_3, 6.4% B_2O_3, 7.0% CuO, and 46.9% P_2O_5 for one and 3.4% Li_2O, 14.9% Na_2O, 8.5% NaF, 21.5% Al_2O_3, 11.8% B_2O_3, 4.0% CuO, and 35.9% P_2O_5 for the other. (J.S.R.)

21237

INVESTIGATION OF THE PROPERTIES OF COPPER-TITANIUM ALLOYS. K. P. Kalinin and M. Z. Spiridonova. Tsvetnye Metal. No. 1, 82-8(1959).

A study was made of the mechanical properties of copper–titanium and chromium–copper–titanium alloys to determine their suitability for structural uses. The solubility of titanium in copper was determined for alloys with 0.3 to 14% titanium. The Vickers hardness, strength, and relative elongation were measured as functions of the titanium content. The results are presented in graphic and tabular form. The conditions for the production of the alloys were determined. The structural properties of the two alloys were compared

with those of beryllium bronze, and it was concluded that copper alloys with 5% Ti and 5% Ti–0.5% Cr are suitable for replacing beryllium bronze. (J.S.R.)

21238

DUST-COLLECTION FROM WAELZ-FURNACE GASES IN UNPACKED SCRUBBERS. N. V. Yur'yev. Tsvetnye Metal. No. 1, 92-3(1959).

The performance of an unpacked scrubber in the removal of dust containing Zn, Pb, and Cd from the off gases of Waelz furnaces was investigated. The scrubber is described in detail. Recirculated clarified solution was sprayed downward concurrently with gas flow. The results suggested that a residence time of 50 to 60 seconds in the scrubber and a spray intensity of 9 to 10 m^3/m^2 hr would give cleaning equal to that obtained by cloth filters. (J.S.R.)

21239

PRODUCTION OF ALLOYS OF NIOBIUM WITH TANTALUM BY THE CARBOTHERMIC (CARBIDE) METHOD. O. P. Kolchin and N. P. Chuveleva. Tsvetnye Metal. No. 2, 60-4(1959).

Niobium–tantalum alloys are as suitable as the pure metals in many applications and are easier to produce. In the work described these alloys were produced by the reaction $Me_2O_5 + 5\ MeC = 7Me + 5O$ (Me = Nb and Ta) which was used previously for these elements. The compositions of the oxides and carbides are shown along with the size grading of the carbides. The carbides mixture was processed over a period of days with 5% excess of the theoretical quantities of the oxides and the resulting mixture was compressed into 10 × 10 × 70 mm bars which were heated to 1800°C in a vacuum by radiation and then by the passage of an electric current. Considerable shrinkage occurred during the heating but the porosity was 20 to 30% and this could be reduced by further treatment. The theoretical density is a function of tantalum content and is based on x-ray determinations. After forging, the density of the specimens approached the theoretical. The bars could be cold-rolled without heat treatment and maximal carbon, titanium, iron, and silicon contents of strip were 0.008, 0.036, 0.002, and 0.003%, respectively. (auth)

21240

MAINTAINING SUPERIOR WELD QUALITY IN A PLUTONIUM PRODUCTION PLANT. C. D. Brons (General Electric Co., Richland, Wash.). Welding J., (N.Y.) 38, 853-9(1959) Sept.

Welding facilities at the Hanford Plant are discussed relative to training facilities and plant production facilities. A training program in welding is discussed. New techniques and procedures are reported. (C.J.G.)

21241

PROPERTIES OF METALLIC MELTS. XVI. THE INTERNAL FRICTION OF EUTECTIC ALUMINUM ALLOYS. Erich Gebhardt and Karl Detering (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 379-85(1959) July. (In German)

The viscosity of melted alloys of aluminum with zinc, silver, and magnesium was investigated in the eutectic range of composition. The course of the viscosity-composition isotherms corresponds to that of the so called L systems, not showing any anomaly at the eutectic concentration. In the concentration range of the compound Al_3Mg_2 a behavior characteristic of the V systems was found. (auth)

21242

CONTRIBUTION TO THE STRUCTURE OF THE NIOBIUM–BORON AND TANTALUM–BORON SYSTEMS. Hans Nowotny (Universität, Vienna) and Friedrich Benesovsky and Richard Kieffer (Metallwerk Plansee Aktiengesellschaft, Reutte/Tirol, Austria). Z. Metallk. 50, 417-23(1959) July. (In German).

The niobium–boron and tantalum–boron systems were investigated with hot-pressed, normal-sintered, and arc melted specimens. Preliminary phase diagrams are given. In both systems the following compounds exist: M_3B_2, MB, M_3B_4, and MB_2 (M stands for Nb or Ta, respectively). The existence of a Ta_2B phase was confirmed. None of these alloys is resistant to scaling. (auth)

21243

CONTRIBUTION TO GRAIN BOUNDARY MIGRATION IN ALUMINUM. Martin May and Friedrich Edrmann-Jesnitzer (Bergakademie, Freiberg i. B.). Z. Metallk. 50, 434-8(1959) July. (In German).

Grain boundary migration in pure aluminum is investigated in dependence on the degree of disorientation, temperature, and external mechanical stress. The results are discussed. (auth)

21244

THE EFFECT OF ADDITIONS ON THE HARDENING OF COPPER–BERYLLIUM ALLOYS. Hans Thomas and Ursula Wilke-Dörfurt (Vacuumschmelze AG, Hanau, Ger.). Z. Metallk. 50, 466-72(1959) Aug. (In German)

The age-hardening process in copper alloys with 2% beryllium and additions of Co, Ni, and Fe is investigated by measurement of the hardness and electric resistance. The influence of additions may be explained in connection with the formation of the tetragonal intermediate phase γ' during the precipitation process. (auth)

21245

CARBON NITRIDE OF NIOBIUM. Georg Brauer and Richard Lesser (Universität, Freiburg i. B.). Z. Metallk. 50, 487-92(1959) Aug. (In German)

Phases and phase boundaries in the ternary system niobium–niobium carbide–niobium nitride are determined by chemical and x-ray methods. Between 1250 and 1450° the four phases α, β, γ, δ were observed. The phase diagram is discussed. (auth)

21246

THE CONSTITUTION DIAGRAM OF Th–Zr ALLOY. T. A. Badaeva and G. K. Alekseenko. Zhur. Neorg. Khim. 4, 1873-80(1959) Aug. (In Russian)

At high temperatures, β_{Th} and β_{Zr} form a continuous series of solid solutions with a body-centered (cubic) lattice. With rapid 1000° tempering, the body-centered lattice holds in alloys with 73.93 to 77.50 at.% Zr; in other alloys the cubic lattice changes into face-centered α_{Th}. The alloy with 40 to 70 at.% Zr disintegrates into two solid solutions with face-centered α_{Th} and α'_{Th}. At 945° and 54 at.% Zr the solid solution undergoes disintegration into two solutions with different zirconium content. At 920° and 40 at.% Zr $\beta_2 \rightleftharpoons \alpha_{Th} + \beta_2$; α_{Th} contains 14 at.% Zr while the β_2 has 69.5 at.% Zr. At 920 to 1380° the solid solution α_{Th} with a face-centered lattice is separated from the thorium-zirconium with a body-centered lattice by two-phase region ($\alpha_{Th} + \beta_1$). (R.V.J.)

21247

DECOMPOSITION OF β SOLID SOLUTIONS Mo–Ti

ALLOYS. N. V. Ageev and L. A. Petrova. Zhur. Neorg. Khim. 4, 1924-7(1959) Aug. (In Russian)

Published data on the β solid solution decomposition mechanism of Ti with 11 wt.% Mo showed that at 200 to 400°C the β solid solution decomposed through an intermediate ω phase ($\beta \rightarrow \beta + \omega \rightarrow \alpha + \beta$). After long periods of treatment at increased temperature, transformation to the α phase occurs at 500°C the β solid solution transformed directly into α phase. Tests carried out with 11, 15, 20, and 93 wt.% Mo showed analogous decomposition mechanisms. Beta solid solutions with 11, 15, 20, and 93 wt.% Mo are stable at 100 to 2450 hours, respectively, at negative and room temperature; at 100° it is stable for 100 hours and at 200°C it is stable for 4 and 81 hours. The 20 and 93 wt.% Mo β solid solutions remain stable for some time at 300,400, and 500°, while solutions with 11 and 15 wt.% Mo disintegrate. The high Mo content solutions remain stable for 1 hour at 300 and 500°C and for 45 min at 400°C. Maximum hardness was found in the $\beta + \omega$ phase. At 400°C it is harder than at 200 to 300°C. (R.V.J.)

21248

CONSTITUTION DIAGRAM OF Cr–Re ALLOYS. E. M. Savitskiĭ, M. A. Tylkina, and K. B. Povarova. Zhur. Neorg. Khim. 4, 1928-30(1959) Aug. (In Russian)

The constitution diagram was plotted for Cr–Re alloy using physicochemical analysis (the temperature of melt, microscopic and x-ray-diffraction analysis and hardness and microhardness with two peritectics of $l + \beta \rightleftharpoons \sigma$ at 2350° and $l + \sigma \rightleftharpoons \alpha$ at 2280°; where α is solid solution with chromium base and β with rhenium base). In the $\sigma + \beta$ double phase the hardness of the alloy reduces from 724 kg/mm^2 for alloy with 88 wt.% (67.5 at.%) Re down to 433 kg/mm^2 for alloys with 93 wt.% (72.5 at.%) rhenium and down to 254 kg/mm^2 for pure rhenium. (R.V.J.)

21249

SOME X-RAY OBSERVATIONS ON THE OXIDATION CHARACTERISTICS OF BINARY NIOBIUM ALLOYS. Ralph H. Hiltz (Thompson Products, Inc., Cleveland). p.71-7 of "Proceedings of the Seventh Annual Conference on Industrial Applications of X-Ray Analysis, August 13-15, 1958, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, 1959. 359p.

Knowledge of the effect of alloying on the oxidation characteristics of niobium is limited almost entirely to oxidation rate and oxygen diffusion rate data. In an effort to determine the mechanism by which alloying elements increase or decrease the oxidation rate of niobium, an x-ray study of niobium alloys was performed. Both x-ray diffraction and fluorescent studies were conducted on the base metal before and after oxidation, on the scale formed, and on the interface between the metal and the scale. From the data obtained, a definite description of the mechanism was not possible, but it appears that the NbO film between the metal and the Nb_2O_5 scale is the rate controlling factor. The elements Ti, Mo, Cr, W, and V which produce a substantial improvement in oxidation resistance effect the formation of a second oxide structure within the NbO film. All the elements which provide a measurable increase in oxidation have either a similar ionic size or a 3+ valence state and in most cases have both. Elements not having a 3+ valence state or similar ionic size, i.e., Cu, Mn, Si, and Zr, do not improve oxidation resistance, in fact Si and Zr act to eliminate the NbO film and the oxidation rate of these alloys is greater than pure niobium. (auth)

21250

CLADDING THICKNESS OF FUEL ELEMENTS BY X-RAYS. Beverley James Lowe, Payson D. Sierer, Jr., and Robert B. Ogilvie (Massachusetts Inst. of Tech., Cambridge). p.275-81 of "Proceedings of the Seventh Annual Conference on Industrial Applications of X-Ray Analysis, August 13-15, 1958, Denver, Colorado." William M. Mueller, ed. Denver, University of Denver, 1959. 359p.

A feasibility study was made to determine the suitability of various techniques for the non-destructive measurement of cladding thickness on uranium fuel elements. The techniques studied were: the attentuation of the characteristic x-ray fluorescence from the uranium base metal by the cladding material, and Compton scattering of x rays from the cladding surface. The cladding materials used in the investigation were aluminum, 304 stainless steel, and zirconium, providing a wide range of both atomic number and density. (auth)

21251

TENSILE CREEP OF PURE AND URANIUM-LOADED GRAPHITES. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V–103. L. Green, Jr., M. L. Stehsel, and C. E. Waller (Aerojet-General Corp., Azusa, Calif.). New York, Engineers Joint Council, 1959. 23p. $0.50.

Tensile creep properties at 2000, 2200, and 2400°C and at three stress levels are reported for four grades of graphite manufactured by the Los Alamos Scientific Laboratory and containing normal uranium (added as UO_2 during the manufacture) in concentrations of zero, 125, 250, and 350 mg/cc. The results are compared with similar LASL measurements reported at the 1958 Geneva Congress. (auth)

21252

PLANSEE PROCEEDINGS, 1958. HIGH MELTING METALS. Papers presented at the Third Plansee Seminar "De Re Metallica," held June 22-26, 1958, Reutte/Tyrol. F. Benesovsky, ed. Reutte/Tyrol, Austria, Metallwerk Plansee AG., 1959. 475p.

The papers given at the Third Plansee Seminar are presented. They are classified into six parts. The first part deals with theoretical questions such as the mechanism of sintering, the second part with tungsten and tungsten alloys, the third part with molybdenum and molybdenum alloys, the fourth and fifth parts with tantalum, niobium, and rare metals and their alloys, and the sixth part with metal-metal oxide materials. (J.S.R.)

21253

IMPROVEMENTS IN OR RELATING TO THE ELECTRODEPOSITION OF BERYLLIUM. Allan Robert Gibson (to United Kingdom Atomic Energy Authority). British Patent 821,091. Sept. 30, 1959.

Electrodeposition of Be from fused salt baths at lower temperatures is described. To a bath of 60 mol. % $BeCl_2$ and 40 mol. % KCl in a stainless steel vessel at 450°C is added 3 wt. % BeS. The Be can then be plated out with a graphite anode and a Ni cathode at 240 amp. per sq. ft. and 3.2 volts. The BeS makes operation more efficient, lower temperatures possible, and halogen evolution lower. (T.R.H.)

21254

SINTERED Ni–Al–Zr COMPOSITIONS. William H. Herz (to Borolite Corp.). U. S. Patent 2,884,688. May 5, 1959.

A corrosion-resistant high-rupture-strength Ni–Al–Zr material is described for use at high temperatures. The material is prepared by powder metallurgy techniques from an intermetallic compound NiAl containing 2 to 7% Zr in solid solution. (T.R.H.)

21255

METHOD OF PRODUCING HAFNIUM-FREE "CRYSTAL-BAR" ZIRCONIUM FROM A CRUDE SOURCE OF ZIRCONIUM. Ivan Edgar Newnham (to Mallory-Sharon Metals Corp.). U. S. Patent 2,885,281. May 5, 1959.

Production of Hf-free crystal-bar Zr is described. The crude source of Zr is carbided with carbon in a graphite resistance furnace, then treated with iodide to form ZrI_4. The ZrI_4 plus iodide impurities is heated with Zr powder in an evacuated vessel to 500°C. This causes ZrI_3 to form and be separated from the more volatile HfI_4 and AlI_3 which deposit on the condenser-lid. The ZrI_3 is further separated from iodides of Fe, and V by heating to 350°C to re-form ZrI_4. The more-volatile ZrI_4 then is collected in pure form on another condenser-lid from which it can be removed and reduced to Zr. (T.R.H.)

21256

PLUTONIUM–ALUMINUM ALLOYS. Fred W. Schonfeld and Clyde R. Tipton, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,885,283. May 5, 1959.

The properties of Pu–Al alloys in the range 85 to 98 at. % Pu are described. (T.R.H.)

21257

METHOD OF FORMING ELONGATED COMPACTS. Harold F. Larson (to U. S. Atomic Energy Commission). U. S. Patent 2,885,287. May 5, 1959.

A powder compacting procedure and apparatus which produces elongated compacts of Be is described. The powdered metal is placed in a thin metal tube which is chemically compatible to lubricant, powder, atmosphere, and die material and will undergo a high degree of plastic deformation and have intermediate hardness. The tube is capped and placed in the die, and punches are applied to the ends. During the compacting stroke the powder seizes the tube and a thickening and shortening of the tube occurs. The tube is easily removed from the die, split, and peeled from the compact. (T.R.H.)

21258

METHOD FOR ELECTRO-NICKEL PLATING WOLFRAM CARBIDE. Harvey L. Slatin (to U. S. Atomic Energy Commission). U. S. Patent 2,885,329. May 5, 1959.

A WC body can be electroplated with Ni after anodic etching in $Na_4P_2O_7$ solution (200 g/l) with a Pb cathode. A current density of 2 amp/in.^{2} for 10 min is sufficient. This allows Ni to be electrodeposited in an adherent coating which is weldable. (T.R.H.)

21259

ALLOYS AND MEMBERS PRODUCED THEREFROM. Robert K. McGeary and Robert D. Leggett (to Westinghouse Electric Corp.). U. S. Patent 2,888,343. May 26, 1959.

Gamma-phase Mo–Nb–U alloy is offered as a corrosion-resistant fuel alloy. One example consisted of 7 wt.% Mo, 2 wt.% Nb, bal. U salt-bath treated to 1950°F, and forged into a flat sheet from which quarter-inch thick specimens were prepared. Heating at 900°C for one day was followed by annealing 7 days at 400°C in He. Maximum corrosion resistance to water at 650°C was secured by a 9 wt.% Mo, 1.4 wt.% Nb composition. (T.R.H.)

21260

ALLOY AND ARTICLES MADE THEREFROM. Roland E. Savidge (to General Electric Co.). U. S. Patent 2,888,345. May 26, 1959.

A corrosion- and erosion-resistant alloy for steam turbine diaphragms is described. In one example, as-cast alloy poured at 2935°F had a composition of 0.04% C, 10.5% Cr, 1.49% Mn, 1.15% Ni, 0.30% Si, 0.03% Mo, and 0.01% V, bal. Fe. The casting was stress relieved 8 hr at 1200°F. The machining and welding properties of these alloys are good. The Brinell hardness of the as-cast metal was dropped from ~320 to 180 by the stress relieving. (T.R.H.)

21261

METHOD OF REFINING METALS. Karl J. Korpi and Raymond C. Johnson (to The Lummus Co.). U. S. Patent 2,890,952. June 16, 1959.

Pure Ti is produced by the reaction of TiO with Ti halides. The Ti ore is first reduced with charcoal or petroleum coke to produce Ti, TiC, TiO, CO, and CO_2. The temperature range 1500 to 2100°C is best. The reduced material is pulverized and charged to a reactor where higher Ti halide vapor reacts to produce TiX_2. Unreacted material is passed to an auxiliary reactor while the liquid TiX_2 goes to a reactor which has Ti-sheathed heating elements. The pure Ti deposits on the heaters. A halide circuit may be set up so that halide from the last reactor may be supplied to the first reactor. (T.R.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

21262 AECU-4324

Brookhaven National Lab., Upton, N. Y.

USE OF THE EVAPOR-ION PUMP WITH THE LINEAR ACCELERATOR. C. L. Gould. Feb. 26, 1957. 4p. (ADD-CLG-6). $1.80(ph), $1.80(mf) OTS.

The pumping system for the Linear Accelerator must meet more stringent requirements than that for the Alternating Gradient Synchrotron ring chamber. The ultimate vacuum must be near 1×10^{-6} mm Hg and the pump must not contribute any contamination to the chamber. This requirement seems to rule out oil diffusion pumps, and leaves as a choice, mercury pumps or getter-ion pumps. A titanium pump on a model section of the linac tank was tested to check gas handling capacity, ultimate vacuum, vacuum when RF power causes extreme outgassing, and build-up of titanium in the tank itself. The model section is a cylinder, 3 ft diameter, 4 ft long, of copper-clad steel. There are perhaps two dozen flanges of various sizes, sealed with "O" rings, spotted around the tank. A standard Evapor-Ion pump is connected through a six-inch valve to the tank, and a 15 CFM mechanical pump is used for roughing out. Considerable difficulty was found in initially obtaining a high vacuum in the tank until some small lucite windows were replaced with glass. The total area of lucite was not over ten square inches but the best vacuum obtainable with the lucite present was 1×10^{-5} mm Hg. When

glass was substituted, 1×10^{-6} was consistently reached. (auth)

21263 NP-7899

Colorado. Univ., Boulder.

HIGH PRECISION MICROWAVE SPECTROMETER FOR 60 kMc. Technical Report No. 3. Robert W. Zimmerer. Aug. 1959. 17p. Contract Nonr-1147(05).

A high-precision microwave spectrometer incorporating several novel ideas was developed to measure the fine structure of the rotational levels of oxygen. The transistions lie between 50 and 65 kMc. These lines have been located and examined but not with the precision possible today. The state of the art in millimeter wave spectroscopy has advanced to the point where precision measurements of the absorption features of oxygen in the 5 mm region can be made. By using the latest developments in several technical fields, a precision spectrometer was successfully engineered and is being used to study 12 transitions to eight significant figures. (auth)

21264 ORNL-2765

Oak Ridge National Lab., Tenn.

COMPUTATION METHODS FOR AVF CYCLOTRON DESIGN STUDIES. M. M. Gordon and T. A. Welton. Sept. 11, 1959. 49p. Contract W-7405-eng-26. $9.30(ph), $3.60(mf) OTS.

A development is given of the theory underlying the numerical methods which have been developed at ORNL for computing the properties of particle orbits in cyclotrons with azimuthally varying magnetic fields. Details of actual computer programs are not given, but such programs can be, and have been, simply laid out by the use of the ideas contained herein. A standard method for describing the magnetic field is given, and the general equations of motion in such a field are given in convenient form. These equations are specialized to the problem of determining equilibrium orbits and properties of small oscillations, and an iterative procedure is given for producing a magnetic field to yield isochronism (equal times for all equilibrium orbits). The emphasis is on a formulation which will lead to efficient use of a high-speed computer. (auth)

21265

THE TANDEM GENERATORS OF THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY. K. W. Allen and F. A. Jilian (Atomic Weapons Research Establishment, Aldermaston, Eng.); W. D. Allen and A. E. Pyrah (Atomic Energy Research Establishment, Harwell, Berks, Eng.); and J. Blears (Metropolitan-Vickers Electrical Co., Ltd., Manchester, Eng.). Nature 184, 303-5(1959) Aug. 1.

The British tandem accelerators at AWRE, Aldermaston, and AERE, Harwell, are briefly described. (T.R.H.)

21266

ON A METHOD OF PROTON EXTRACTION FROM A SYNCHROTRON. M. A. Gan'zhin (Joint Inst. of Nuclear Research, Dubna, USSR). Pribory i Tekh. Ekspt. No. 4, 22-4(1959) July-Aug. (In Russian)

Extraction of accelerated protons by means of a retarding target and deflecting magnet is studied. A deflecting magnet with a heterogeneous field is suggested for obtaining better extracted beam parameters. A design for optimal extraction conditions is described. (tr-auth)

21267

STABILIZATION OF INTENSITY OF HIGH-VOLTAGE ACCELERATOR BY BREAK SYSTEM. B. S. Novikovskiĭ. Pribory i Tekh. Ekspt. No. 4, 140-1 (1959) July-Aug. (In Russian)

Cascade generator stabilization by a break system interval is described. The stabilizing element is located between the low-voltage outlet of the high-intensity source and the ground. With the ion beam passing the grounded target between the last electrode on the acceleration tube and the ground, potential differences appear which slow down the particle beam. Stabilization of the beam energy is achieved by regulating the magnitude of these potential differences. (R.V.J.)

21268

DUO PLASMATRON ION SOURCE FOR USE IN ACCELERATORS. C. D. Moak, H. E. Banta, J. N. Thurston, J. W. Johnson, and R. F. King (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 30, 694-9 (1959) Aug.

Evaluations of various sources for accelerator use at proton currents above 10 ma indicate that a variation of Von Ardenne's Duo Plasmatron will give performance superior to that of any other source presently available. Operating characteristics for various sizes of the source have been examined for H_1^+, H_2^+, H_3^+, H_1^-, He^+, and He^{++} ions and electrons. Experience with protons in the current range from 1 to 30 ma indicates that the Duo Plasmatron can deliver up to 100 amp/cm^2 of exit aperture area. Current densities such as this cannot be maintained in the accelerator-extractor section because of space charge forces, even at the highest gradients normally available for well-polished electrodes in vacuum; thus it can be said that proton current densities will be space-charge-limited by the accelerator rather than emission-limited by the source. Operation for He^+ ions and electrons is similar to proton operation. Currents of 11 μa of H_1^- ions and 5 μa of He^{++} ions were extracted directly from a source which had been designed for a proton current of several milliamperes. The most striking features of the Duo Plasmatron are its remarkably high brilliance, high gas efficiency, good power economy, and compactness. (auth)

21269

UTILIZATION OF STRONG FOCUSING IN SHAPING ELECTRIC DEFLECTORS. V. V. Krotov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 716-25(1959) June. (In Russian)

The influence of electric field gradients along the electric deflector on the focusing of a beam extracted from a cyclotron chamber is investigated. The strong focusing effect in a two-section extraction channel is utilized for achieving vertical focusing. The first section has a flat profile (the first magnetic lens). Various methods are suggested for determining the channel parameters. (tr-auth)

21270

ON A CYCLOTRON WITH A CURVED ACCELERATING SLIT. N. K. Abrosimov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 726-8(1959) June. (In Russian)

The principle of the particle accelerator with a curved accelerating slit suggested by Y. P. Varshni (Nucl. Instr. 1, 280, 1957) is analyzed and shown to be impractical. (R.V.J.)

21271

THE BETATRON CAPTURE THEORY. L. M. Kovrizhnykh and A. N. Lebedev (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Tekh. Fiz. 29, 732-7(1959) June. (In Russian)

Mathematical expressions were previously developed for evaluating collective interactions of particles in cyclic accelerators and applied for problems of electron capture in betatrons. Some new data are offered and other mechanisms of capture are discussed. A detailed analysis is made of the physical picture of capture. (R.V.J.)

21272

THERMOELECTRIC HEAT-PUMPS. Nils E. Lindenblad (to Radio Corp. of America). U. S. Patent 2,884,762. May 5, 1959.

A temperature-cascaded thermoelectric pile arrangement is described in which the effect of a bank of thermocouples can be multiplied repeatedly to produce effective cooling. (T.R.H.)

21273

GAS TARGET. Robert J. Van de Graaff (to High Voltage Engineering Corp.). U. S. Patent 2,885,584. May 5, 1959.

A gas target arrangement for accelerators is described which avoids use of an irradiation window for a contained gas. The gas molecules are projected into the beam from a nozzle and then collected and recirculated. The gas jet enters the beam in such a way as to minimize diffusion into the evacuated beam area. A series of restriction tubes further prevents gas from back diffusion. A heating coil and dry ice arrangement serve as pump. (T.R.H.)

21274

VARIABLE OUTPUT CONTROL FOR LINEAR ACCELERATORS. Alfred F. Bischoff (to General Electric Co.). U. S. Patent 2,887,580. May 19, 1959.

An electronic system is described which continually optimizes the input of an electron accelerator wave guide to control the output. A pulsed r-f power supply introduces energy to the wave guide the frequency of which is controlled by a frequency adjusting circuit. The output is continuously monitored and a mixing circuit is provided to combine output and power supply signals and apply the resultant to the frequency adjuster. (T.R.H.)

21275

ELECTRON ACCELERATOR FOR IRRADIATION. Roy M. Emanuelson (to High Voltage Engineering Corp.). U. S. Patent 2,887,583. May 19, 1959.

An electron accelerator for irradiation of various materials is described. The beam is divided and deflected by magnets so that two beams are directed at the object to be irradiated from opposite directions. Symmetry of the radiation field is thus assured. The electrons travel in an evacuated vessel during the time the deflection occurs, minimizing scattering loss. Damage to the accelerator from back streaming electrons is avoided by this arrangement, giving greater service life. (T.R.H.)

21276

ELECTRON IRRADIATION APPARATUS. John C. Nygard (to High Voltage Engineering Corp.). U. S. Patent 2,887,584. May 19, 1959.

An arrangement for irradiation with electrons is described which avoids certain hazards associated with other techniques. The space between accelerating-tube window and object to be irradiated is filled with He or Ar. The He or Ar, being lighter than air, are contained by a hood the bottom of which is open to permit raising of objects to be irradiated to the window. Thus electron losses in air are avoided along with hazards from ozone formation and from accidental breakage of the irradiation window. (T.R.H.)

21277

ELECTRON ACCELERATION TUBE. John G. Trump (to High Voltage Engineering Corp.). U. S. Patent 2,887,599. May 19, 1959.

An electron accelerator is described which is useful for radiation processing of large areas such as paint on automobiles or ink on printed pages. The current is supplied by a gas-insulated cable to electrodes housed in an evacuated vessel thereby avoiding structural supports and other disadvantages of conventional arrangements. (T.R.H.)

21278

CALUTRON CATHODE INTERLOCK CIRCUIT. Lawrence W. Baldwin (to U. S. Atomic Energy Commission). U. S. Patent 2,888,563. May 26, 1959.

A circuit arrangement is described which prevents application of the arc voltage to an ion source of a calutron before the cathode has been heated to operating temperature. (T.R.H.)

21279

CALUTRON PROTECTIVE CIRCUIT. Fred H. Schmidt (to U. S. Atomic Energy Commission). U. S. Patent 2,888,564. May 26, 1959.

A switch and relay circuit is described for protection of calutrons. By means of this arrangement no arc can be established in the arc chamber unless cooling water flow is established. (T.R.H.)

21280

CALUTRON. William M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,888,565. May 26, 1959.

A calutron with improved supports and insulation is described. The operative elements are securely mounted but are easily accessible for inspection and servicing. (T.R.H.)

21281

ION SOURCE SLIT CLEANER FOR CALUTRON. Ernest O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,888,566. May 26, 1959.

A mechanical scraper for cleaning calutron ion source slits is described. (T.R.H.)

21282

CALUTRON ION SOURCE. Frank F. Oppenheimer (to U. S. Atomic Energy Commission). U. S. Patent 2,889,462. June 2, 1959.

A shielding arrangement for eliminating oscillating electrons in the ion source region of calutrons is offered. Metal plates are attached to the ion generator so as to intercept the magnetic field between ion generator and accelerating electrode. The oscillating electrons are discharged on the plates. (T.R.H.)

21283

ION BEAM FOCUSING MEANS FOR CALUTRON. John G. Backus (to U. S. Atomic Energy Commission). U. S. Patent 2,890,337. June 9, 1959.

An ion beam focusing arrangement for calutrons is

described. It provides a virtual focus of origin for the ion beam so that the ions may be withdrawn from an arc plasma of considerable width providing greater beam current and accuracy. (T.R.H.)

21284

ION PRODUCING MECHANISM. Frank F. Oppenheimer (to U. S. Atomic Energy Commission). U. S. Patent 2,890,339. June 9, 1959.

A calutron ion source is described which masks the ends of the arc to provide a more stable beam from the middle portion. The masking is effected by milling the arc slit in a single sheet of material which is secured to the open face of the arc block. (T.R.H.)

21285

CALUTRON. William M. Brobeck, Edward J. Lofgren, and Robert L. Thornton (to U. S. Atomic Energy Commission). U. S. Patent 2,890,340. June 9, 1959.

A calutron improved in liner and capacity is offered. The liner is a hollow insulated structure at high negative potential with respect to the vessel. The liner has delimiting vanes to prevent ions from one beam scattering into the receiver from another beam. The double beam–double receiver feature is thus made possible, increasing the capacity of the calutron. (T.R.H.)

21286

SYSTEM FOR CHARGE NEUTRALIZATION. Maynard J. Columbe (to General Electric Co.). U. S. Patent 2,890,342. June 9, 1959.

In electron-diffraction analysis free electrons knocked off the sample give it a positive charge which repels the electron beam, causing distortion in the diffraction pattern being observed. This effect may be overcome by an auxiliary source which sprays low-voltage electrons on the target. These electrons are guided to the target by a low-voltage shield and deflector arrangement. This low-voltage beam replaces electrons knocked off by the high-voltage beam. (T.R.H.)

21287

PARTICLE ACCELERATOR. Tihiro Ohkawa (to U. S. Atomic Energy Commission). U. S. Patent 2,890,348. June 9, 1959.

A fixed-field alternating gradient accelerator for simultaneous acceleration of two particle beams in opposite directions is described. (T.R.H.)

21288

CALUTRON. William E. Parkins (to U. S. Atomic Energy Commission). U. S. Patent 2,891,161. June 16, 1959.

A calutron target arrangement is described which follows the shifting focus of the beam. Four magnets attached to the face of the receiver are arranged so that they are in magnetic equilibrium when the beam focus is properly aligned. Twisting of the beam causes heating of some of the magnets disturbing the equilibrium by permeability changes. The magnets restore equilibrium by moving the receiver face to proper alignment. (T.R.H.)

21289

CALUTRON RECEIVER. Sidney W. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,891,162. June 16, 1959.

An improved receiver and receiver mount for calutrons are described. The receiver can be manipulated from outside the tank by a single control to position it with respect to the beam. A door can be operated exteriorly also to prevent undesired portions of the beam from entering the receiver. The receiver has an improved pocket which is more selective in the ions collected. (T.R.H.)

21290

CALUTRON. Arnold F. Clark (to U. S. Atomic Energy Commission). U. S. Patent 2,891,163. June 16, 1959.

A means of eliminating oscillating electrons from the arc slit region of calutron ion sources is offered. Free electrons and ions generated by the beam bombarding atoms of ambient atmosphere are discharged by a fin arrangement which sets up an electric field. The discharged ions travel toward a recess in which a "fin and blister" effect limits oscillations to one region from which they are removed by reversed electric fields. (T.R.H.)

PHYSICS AND MATHEMATICS

General

21291 AAEC/E-31

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

TWO GROUP THEORY FOR EXPLORATORY H.T.G.C. REACTOR CALCULATIONS. J. J. Thompson. Aug. 1958. 12p.

A method is described for the manipulation of the solutions of two-group diffusion theory for a reflected sphere. Matrices are used to give a simple treatment useful for practical computation. The critical equation is formulated in terms of a second-order determinant only, which yields a measure of the amount of hypothetical absorber required between core and reflector for criticality, and therefore is a basis for a comparative study of systems. Sufficient equations are presented to enable both flux and adjoint flux distributions to be calculated. In addition, the basic results for the formulation of the critical equation for cylinders with either radial or end reflectors are given. (auth)

21292 AAEC/E-32

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

A NOTE ON THERMO-ELASTIC STRESS IN AXIALLY SYMMETRIC ANISOTROPIC CYLINDERS. J. J. Thompson. Aug. 1958. 5p.

The equations of elasticity are used to determine the axially symmetric thermo-elastic stresses and displacements for an anisotropic cylinder with elastic symmetry under conditions of plane strain. (auth)

21293 AD-82282

California Inst. of Tech., Pasadena. Electron Tube and Microwave Lab.

PLASMA OSCILLATIONS AND RADIO NOISE FROM THE DISTURBED SUN. Technical Report No. 4. Roy W. Gould. Nov. 1955. 133p. Contract Nonr-220(13).

It has been suggested that plasma oscillations in the solar corona may be the source of large bursts of radio noise in the meter wavelength region. Two aspects of this problem are considered: (a) the excitation of plasma oscillations by directed beams of charged particles and (b) the conversion of energy in the longitudinal plasma oscillations to transverse electromagnetic waves by means of random inhomogeneities in electron density. (auth)

21294 AD-209301

California Inst. of Tech., Pasadena and California. Univ., Los Angeles.

PROCEEDINGS OF A SEMINAR ON ADVANCED ENERGY SOURCES AND CONVERSION TECHNIQUES HELD AT PASADENA, CALIFORNIA, NOVEMBER 3-7, 1958. 269p. Contract DA-36-039-SC-78064. (PB-151461). $4.00(OTS).

The Seminar was organized as a series of tutorial presentations and round table discussions on a technical level to implement the following: (a) to identify and explore present and projected needs for energy sources and conversion techniques for military applications; (b) to exchange information on current and planned efforts in these fields; (c) to examine the effect of anticipated scientific and technological advances on these efforts; and (d) to present suggested programs aimed at satisfying the military needs for energy sources and conversion techniques. Volume I contains all of the unclassified papers presented at the Seminar. (W.D.M.)

21295 AE-6

Aktiebolaget Atomenergi, Stockholm.

MONTE CARLO CALCULATIONS OF NEUTRON THERMALIZATION IN A HETEROGENEOUS SYSTEM. T. Högberg. June 1959. 22p.

The slowing down of neutrons in a heterogeneous system (a slab geometry) of uranium and heavy water was investigated by Monte Carlo methods. Effects on the neutron spectrum due to the thermal motions of the scattering and absorbing atoms are taken into account. It was assumed that the speed distribution of the moderator atoms are Maxwell-Boltzmann in character. (auth)

21296 AECU-4282

Oklahoma State Univ., Stillwater. School of Mechanical Engineering.

STATUS REPORT ON A STUDY OF THE USE OF FURNACE CALORIMETRY FOR THE RAPID DETERMINATION OF SPECIFIC HEAT OF SOLIDS AT HIGH TEMPERATURES. J. H. Boggs, R. A. Knezek, and J. A. Wiebelt. Aug. 1959. 13p. Project No. 6. Contract AT(11-1)-71. $3.30(ph), $2.40(mf) OTS.

Specific heat values for Mo, V, and Ta were investigated from 1200 to 2000°F. It is noted that the measurements vary from values presented in the literature. These data are not presented, however, they are considered indicative of progress. The new equations for specific heat have a maximum variation of 7.9%. A system for recording and controlling furnace heat was obtained. It is believed that 2700°F is the maximum obtainable temperature for this system. (J.R.D.)

21297 AECU-4283

Goodyear Tire and Rubber Co., Akron, Ohio.

ISOTOPIC METHOD FOR AGE DETERMINATION OF INDUSTRIAL PRODUCTS. Quarterly Progress Report [for] April–June 1959. T. C. Gregson and S. W. Waisbrot. 39p. Contract AT(11-1)-719. $6.30(ph), $3.00(mf) OTS.

A method is described for the use of two radioisotopes for dating purposes. The two isotopes consisted of a long-lived standard and a short-lived timer. In appendix two an age equation is presented for the case of a pure beta emitting isotope pair in which the hard radiation emitter is the long-lived nuclide. In appendix three the hard radiation contamination of Tc^{99} beta radiation is discussed. The error in measurement of short-lived nuclide activity resulting from contamination by another radioactive species is discussed in appendix four. In appendix five the age equation for a special case of isotope pair based on self generation of long-lived daughter is presented. (W.L.H.)

21298 AECU-4318

Illinois. Univ., Urbana. Digital Computer Lab.

THE ARITHMETIC UNIT. Report No. 92. David J. Wheeler. Aug. 21, 1959. 29p. Contract AT(11-1)415. $4.80(ph), $2.70(mf) OTS.

Design details of an asynchronous arithmetic unit using logical elements are given. The unit is not too expensive and high speed operation is possible. The unit is designed primarily for floating point operations with the additional requirement that the accumulator should hold results to double precision. Double precision operations are fairly easy to code. (W.D.M.)

21299 AECU-4332

Northwestern Univ., Evanston, Ill.

RADIATION EFFECT OF POSITIVE ION BOMBARDMENT. Progress Report for June 16, 1959 to August 15, 1959. R. L. Hines. Sept. 5, 1959. 4p. Project No. 15. Contract AT(11-1)-89. $1.80(ph), $1.80(mf) OTS.

Experiments aimed at determining the ranges of ions in metals are reported. Work done on the sputtering ratio of quartz by Xe^{+} ions at energies of 20, 30, 40, 50, and 60 kev is discussed; measurements are not quite complete. Analysis of bombarded quartz samples is continuing and a method for analyzing the reflection coefficient versus wave length was completed for use in determining the depth and change in refractive index in the bombarded region. The present status of the quartz bombardments is presented tabularly. (J.R.D.)

21300 AECU-4347

Illinois. Univ., Urbana and Argonne National Lab., Lemont, Ill.

SOME SIMPLE FEATURES OF THE MÖSSBAUER EFFECT. Harry J. Lipkin. [1959]. 12p. $3.30(ph), $2.40(mf) OTS.

A simple description is given of the change in the state of a crystal lattice upon emission or absorption of a nuclear gamma ray. A sum rule is derived for the average energy transfer to the lattice. The probability of zero energy transfer is calculated. The results are general and do not assume a particular model for the crystal. Conclusions are presented as simple principles which may be useful as a guide to experimentalists. (auth)

21301 AERE-Bib-121

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

OSCILLATING ELECTROMAGNETIC FIELD INTERACTION WITH, AND CONTAINMENT OF, PLASMAS. A Bibliography. F. B. Knox and C. S. Sabel, comps. June 1959. 34p. $0.77(BIS).

References are compiled from Science Abstracts A from 1950 to 1959, from Nuclear Science Abstracts, and from library card catalogs. References are arranged alphabetically within each year. An author index is included. (J.E.D.)

21302 AERE-L-102

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

LECTURES ON THE HYDROMAGNETIC STABILITY OF A CYLINDRICAL PLASMA. I. INTRODUCTION AND

THE METHOD OF NORMAL MODES. R. J. Tayler. June 1959. 20p. $0.42(BIS).

This series of lectures is mainly concerned with the stability against small perturbations of a cylindrical plasma which is assumed to behave as an ideal hydromagnetic fluid. In the first part, the hydromagnetic equations are stated, and the basic ideas of linear stability analysis are developed. It is pointed out that a plasma may not behave as an ideal fluid and that nonlinear terms may have an important influence on stability problems. One method of solving linear stability problems is that of normal modes. A general perturbation of a plasma surface does not preserve its form as it grows or decays. Certain perturbations do preserve their form and are called normal perturbations and a general perturbation can be expressed in terms of normal perturbations. The stability of the system can be investigated by finding whether any of the normal modes are unstable. This method is applied to two simple examples, one from rigid dynamics and the other from hydromagnetics. (auth)

21303 AFCRC-TN-59-248

New York Univ., New York. Inst. of Mathematical Sciences.

NON-ADIABATIC TREATMENT OF ELASTIC SCATTERING OF ELECTRONS BY ATOMIC HYDROGEN. Research Report No. CX-37. Kazem Omidvar. Jan. 1959. 53p. Contract AF19(604)-4555. (AD-211495).

The elastic scattering of electrons by atomic hydrogen including the effects of exchange and polarization is calculated. To include the exchange effect the total spin and space function of the incident and the bound electrons is made antisymmetric with respect to interchange of the two electrons. In this way an equation for the wave function of the incident electron similar to the Fock equation is obtained. To include the effect of polarization of the hydrogen atom by the incident electron the wave function for the bound electron is taken in such a way that the electrostatic potential energy between the incident electron and the atom with this wave function becomes equal to the average Coulomb and dipole potential energy of the incident electron, the dipole potential being determined by the experimental value of the polarizability of the hydrogen atom. Since the exchange potential depends on the form of the bound electron wave function, the effect of polarization on the exchange effect is also taken into account. The equation for the wave function of the incident electron is reduced to a set of radial integro-differential equations by the method of partial waves. These equations are integrated numerically using for the bound electron wave function: first, the ground state hydrogenic wave function, and, second, the wave function calculated according to the above scheme. The result is that in the second case the calculated curve for the total elastic cross section reproduces most features of the experimental curve for the total elastic scattering cross section of electrons by hydrogen atoms. (auth)

21304 AFOSR-TN-59-286

Texas. Agricultural and Mechanical Coll., College Station.

SPIN-LATTICE RELAXATION TIMES IN BINARY SOLUTIONS. R. W. Mitchell and M. Eisner. Mar. 1959. 39p. Contract AF18(600)-1300. (AD-212919).

Measurements of spin lattice relaxation time (T_1) in binary mixtures at 43 gauss are presented. Results are compared with the predictions of the Debye model and others. T_1 results for C_6H_{12}, C_6H_6, C_6H_5Cl, C_6H_5Br, o-$C_6H_4Cl_2$, and p-$C_6H_4Cl_2$ are presented as a function of concentration in CS_2 and CCl_4. Data on $(\eta T_1)^{-1}$ where η is the solution viscosity are presented graphically, and values of T_1 for the hydrogen nuclei in isolated molecules are tabulated. (J.R.D.)

21305 AFOSR-TN-59-489

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

THE ELECTRICAL CONDUCTIVITY OF A PARTIALLY IONIZED GAS. A. C. Pipkin. Apr. 1959. 32p. Contract AF49(638)-401. (BN-170; AD-215842).

The electrical conductivity of a gas in a magnetic field may be calculated from the transfer equations. These equations in obtaining the conductivity of a fully ionized gas were used, and an approximate expression for the conductivity of a partially ionized gas was obtained by neglecting the influence of heat conduction. Heat conduction is taken into account. The calculation makes use of an approximation based on the smallness of the electron-ion mass ratio. A further approximation based on the smallness of neutral atom collision cross sections in comparison to Coulomb cross sections is possible when the temperature is not too high, but this approximation is used only after the general expression for the conductivity has been obtained. (auth)

21306 AFOSR-TN-59-758

Maryland. Univ., College Park.

VIBRATIONAL THERMODYNAMIC PROPERTIES OF LATTICES WITH DEFECTS (thesis). Technical Report No. 145. Jagadishwar Mahanty. Aug. 1959. 100p. Contract AF49(638)-399.

Some techniques are developed for evaluating the changes in the vibrational properties of a lattice due to the presence of defects, and they are applied to the study of the effect of defects on some lattice models. The techniques are based on the work of Montroll who gave a method for obtaining integral expressions for the change due to defects in an additive function of the normal mode frequencies of a lattice. The integral expressions for the changes in vibrational thermodynamic properties are contour integrals of functions whose poles are distributed in such a way that integration becomes inconvenient. It is shown in that if one is restricted to the evaluation of the change in thermodynamic properties at low and high temperatures, the need for integrating over such singular functions can be avoided by using some special devices. These devices lead to some useful formulas which are employed in the study of the effect of isotope and substitutional impurities in one, two, and three dimensional lattices with nearest neighbor central and noncentral force interactions. Results are given for the low- and high-temperature values of the change in Helmoholtz free energy due to defects in these cases. Methods for extending the applicability of these techniques to the case of more complicated lattices are indicated and the discrete frequencies that arise due to an isotope defect in lattices with coupled displacement components are computed. (auth)

21307 AFOSR-TN-59-879

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

THE WAVE MOTIONS OF SMALL AMPLITUDE IN RADIATION-ELECTRO-MAGNETO-GAS DYNAMICS. S. I. Pai and A. I. Speth. July 1959. 23p. Contract AF49(638)-401. (BN-180).

The fundamental equations of radiation-electro-magneto-gas dynamics are discussed. These equations

are linearized under the condition that there exists an externally applied uniform magnetic field. Wave motions of infinitesimal amplitude which may be divided into a transverse wave and a longitudinal wave, are analyzed. Radiation phenomena exert influence only on the longitudinal wave while the transverse wave is independent of the radiation field. The radiation effect is characterized by introducing a radiation parameter which is the ratio of radiation pressure to the gas-dynamic pressure. For ideal plasma, it may be expressed in terms of an effective radiation sound speed. Various simple cases of this wave motion of small amplitude in radiation electro-magneto-gas dynamics are discussed. The condition where the radiation effect becomes important is also discussed. (auth)

21308 APEX-466

Nuclear Development Corp. of America, White Plains, N. Y.

NEUTRON CROSS SECTIONS FOR ZIRCONIUM AND YTTRIUM. N. Tralli. June 30, 1958. Decl. Aug. 31, 1959. 47p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Contracts AF33(600)-38062 and AT(11-1)-171. Subcontract AT-70. $7.80(ph), $3.30 (mf) OTS.

The studies of the cross sections of zirconium and yttrium with neutron diffusion data, inelastic scattering data, and photon activation data are given. All cross sections are reported as obtained and as group-averaged and digitalized cross sections. The groups over which the cross sections were to be averaged, the averaging procedure, and the digitalization procedure were specified so that the results obtained would be readily usable in the GE reactor calculation procedure. (auth)

21309 APEX-505

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

BOUNDARY VALUE PROBLEMS FOR HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS. J. F. Heyda. Nov. 1958. 24p. Contracts AF33(600)-38062 and AT(11-1)-171. $0.75(OTS).

A self-contained exposition is given for methods of solving Cauchy and characteristics-type boundary value problems for linear hyperbolic partial differential equations in two independent variables with constant coefficients. Illustrative examples, taken from current engineering literature, are cited to indicate the importance and frequency of occurrence of such equations in technical problems. (auth)

21310 ARGMA-TN-1C1N-22

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

RESEARCH LABORATORY QUARTERLY RESEARCH REVIEW NO. 22 [FOR] MAY 1, 1959 THROUGH JULY 31, 1959. Sept. 1, 1959. 48p.

Tests were conducted with Al specimens loaded in tension, and combined tension and bending. Equations for use in estimating safe loading are presented, however, a knowledge of the material tensile strength and a relation between the initial and fracture eccentricity are required. An initial experiment to compare true and chance coincidence rates with a Ba^{131} source was performed. Sufficient data were obtained to determine the true triple coincidence rate by use of a derived formula. Combustion instabilities in flame propagation down a tube were investigated. The effects of fuel chemical differences were examined and observations of flames produced from combustion of butane–oxygen–inert gas mixtures, and carbon monoxide–oxygen inert gas flames are presented. Measurements of axial current distribution in a plasma jet arc heater were conducted. Results indicate the feasibility of a new nozzle design which should reduce contamination of the gas being heated. Data on current distribution in nozzle flow using nitrogen, helium, or argon are given. Tests of a fully ionized plasma device of the pinch type for production of gases at high temperatures is reported. Circuit diagrams are given, and conditions for a typical experiment are listed. For preceding period see ARGMA-TN-1C21N-1. (J.R.D.)

21311 ARO-1

Office of the Chief of Research and Development. Army Research Office, Washington, D. C.

STATUS REPORT ON FUEL CELLS. B. R. Stein. June 1959. 121p. (AD-219389).

A survey of recent advances in the field of fuel cell research and development has been made. Military requirements and interests are discussed, and a brief historical summary, bibliography, discussion of known fuel cell systems, and a tabulated abstract of the Department of Defense supported program are included. Appendices to the report comprise sections concerned with definitions, detailed fuel cell system data, and basic thermodynamic considerations. Also, a treatment of the production, storage, and handling of hydrogen, oxygen, and carbon monoxide is given along with summary information on all Government contracts, and a list of Department of Defense basic research support projects. (auth)

21312 BNL-4152

Cornell Univ., Ithaca, N. Y.

VAPOR PRESSURE OF THE Bi–BiI_3 SYSTEM. Period Covered: November 1, 1951 to September 30, 1952. R. L. Von Berg and W. A. Chantry. Decl. June 24, 1959. 29p. For Brookhaven National Lab. Contract AT-30-2-GEN-16, Sub-S-225. $4.80(ph), $2.70(mf) OTS.

The vapor pressures of solutions of BiI_3 in molten bismuth and in molten alloys of bismuth and other heavy metals over a range of 300 to 600°C was investigated. Methods of preparation, purification, and analysis of BiI_3 were investigated, various types of apparatus fo vapor pressure measurements were built and tested, and vapor pressure and vapor density of pure BiI_3 were determined by several methods. The composition of the solutions studied was in the range of 1 to 10% BiI_3 by weight. Solutions of lower percentage BiI_3 were not investigated because the techniques used would not give a reasonable accuracy at lower concentrations. Knowledge of the behavior of solutions of much lower concentrations is of greatest interest, and it is hoped that the results obtained will be helpful in predicting the vapor pressure over solutions of very low concentration. (auth)

21313 CF-59-9-20

Oak Ridge National Lab., Tenn.

PROGRAMMERS MANUAL; ORACLE BINARY INTERNAL TRANSLATOR (ORBIT). ALGEBRAIC PROGRAMMING SYSTEM FOR THE ORACLE. A. A. Grau, M. Feliciano, G. C. Caldwell, E. L. Cooper, A. Culkowski, and J. Harrison. Sept. 22, 1959. 89p. Contract W-7405-eng-26. $13.80(ph), $4.80(mf) OTS.

The present edition of the Programmers' Manual for the ORACLE Binary Internal Translator has been com-

pletely revised and considerably expanded. At the same time, the Translator program itself has also undergone complete revision. The new version of ORBIT will accommodate programs written in accordance with the original instructions with minor exceptions; the end-of-page sentinel, for instance, was simplified. Added flexibility was incorporated by the introduction of a number of unary operations, sin, cos, arctan, exp, sqrt, etc., which make possible the expression of any elementary function in ORBIT language. This feature should increase the usefulness of the system. (auth)

21314 CRT-856

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

SOME INTEGRALS INVOLVING THE BESSEL FUNCTION INTEGRALS. B. Davison. July 1959. 20p. (AECL-867). $0.50(AECL).

A systematic procedure for reducing the integrals $F_{n,k}(x) = 2/\pi \int_0^{\pi/2} \cos^k\phi d\phi \int_1^\infty \exp[-2xt\cos\phi(t^n\sqrt{t^2-1})^{-1}]\,dt$ is presented where n and k are nonnegative integers and (n + k) is even. (J.R.D.)

21315 CU-185

Columbia Univ., New York.

NEUTRON RESONANCES IN U^{238} (thesis). Jerome Leonard Rosen. May 6, 1959. 73p. Contract AT-30-1-Gen-72. $2.00(OTS).

The results of time-of-flight measurements of U^{238} resonances in the region 90 to 1300 ev are presented, and resonance parameters for levels up to 1000 ev are obtained. Neutron widths for the 55 observed levels and radiation widths for 32 of the stronger levels are deduced. The reduced neutron width distribution is found to be in good agreement with the theoretical prediction of Porter and Thomas for a single channel process, while the level spacing distribution agrees with the "repulsion" formula suggested by Wigner. The average values of the radiation width, reduced neutron width, and level spacing are in agreement with the earlier, more uncertain values of other workers. It appears on the basis of their size and number, that several of the weakest levels may be due to p wave neutrons. The generation of the pulsed neutron beam, the detection scheme, the time-of-flight apparatus and the theory and methods of analysis are discussed. (auth)

21316 GEAP-0952

General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.]

VALPROD, A REVISION OF THE PROD II 650 MULTIGROUP PROGRAM. R. H. Stark and C. M. White. Jan. 9, 1957. 16p.

An extensive modification of the PROD II multigroup code which was obtained from KAPL has been completed. This modification has mainly to do with ease of application. It does not add any new features to the generality of PROD II, but it is far more economical and convenient to use. Furthermore, almost all the generality of PROD II is retained. One important feature is that VALPROD is designed to solve problems serially rather than in parallel as was the use with PROD II. This permits use of the power distribution from one problem as a guess for the next. (auth)

21317 JPL-30-1

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

EXPLORATION OF THE MOON, THE PLANETS, AND INTERPLANETARY SPACE. Albert R. Hibbs, ed. Apr. 30, 1959. 130p. Contracts DA-04-495-Ord-18 and NASw-6.

A survey was made at JPL of possible objectives in a program of exploration of the moon, the planets, and interplanetary space. This has been combined with a survey of the feasibility of engineering developments which would be required by such an exploration program. The basis on which the study was conducted is described, and a review of current knowledge about the moon, the planets, and interplanetary space is presented. A brief summary of the results of the Laboratory study on the feasibility of a program for the exploration of space and a program of lunar and interplanetary flights are given, and the necessary development activities to support the exploration program are outlined. The time scale covered extends from 1959 through 1964. (T.R.H.)

21318 LA-2308

Los Alamos Scientific Lab., N. Mex.

X-RAY CRYSTALLOGRAPHIC EXTRAPOLATION FUNCTIONS. Charles P. Kempter, Dorothy L. Cooper, and Thomas L. Jordan, Jr. Mar. 1959. 193p. Contract W-7405-eng-36. $3.00(OTS).

The proper use of extrapolation functions for the precision determination of crystal lattice constants is discussed. Tabulations are made of the following functions: $\phi \tan\phi$ vs. θ and ϕ (0.01° intervals) from 59.00 to 89.99° θ; $\cos^2\theta$ and $1/2\,(\cos^2\theta/\sin\theta + \cos^2\theta/\theta)$ vs. θ (0.01° intervals) from 10.00 to 89.99° θ; and $\cos\theta\cot\theta$ vs. 2θ (0.01° intervals) and θ from 100.00 to 165.99° 2θ. (auth)

21319 LA-2316

Los Alamos Scientific Lab., N. Mex.

THERMAL CONDUCTIVITY OF HELIUM AND HYDROGEN AT HIGH TEMPERATURES. Joseph B. Mann and Normand C. Blais. Apr. 1959. 39p. Contract W-7405-eng-36. $1.25(OTS).

A steady-state hot wire method for measuring the thermal conductivity of light gases in the temperature range 1200 to 2100°K is described. In contrast to other methods, free convection currents and large temperature gradients occur; convection effects are shown to be negligible, and an experimental procedure for eliminating the large gradient effects is described. The thermal conductivity of helium is found to follow the equation $\lambda \times 10^6 = 991 + 0.678(T - 1200)$ cal/sec cm deg over the temperature range covered. That for hydrogen is $\lambda \times 10^6 = 1434 + 1.257(T - 1200)$ cal/sec cm deg. (auth)

21320 LAMS-2325

Los Alamos Scientific Lab., N. Mex.

HIGH TEMPERATURE MEASURING TECHNIQUES, 1948 TO PRESENT. Bibliography. Ruth H. Lier, comp. Apr. 1959. 43p. Contract W-7405-eng-36. $1.25(OTS).

This bibliography is mainly concerned with thermocouples, resistance bulbs, sonic pyrometer, infra-red and radiation pyrometers, and microwave techniques. The following literature was searched: Physics Abstracts, Volumes 51 through 61, Nuclear Science Abstracts, Volumes 1 through 12, and Los Alamos Scientific Laboratory Report Library Card Catalog. (auth)

21321 LMSD-48394

Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.

INCOHERENT MICROWAVE RADIATION FROM AN

IONIZED GAS CONFINED BY A MAGNETIC FIELD. PART 1. MICROSCOPIC PICTURE—RADIATION EMITTED THROUGH A LARGE DIFFUSE BOUNDARY. PART 2. MACROSCOPIC PICTURE—RADIATION EMITTED THROUGH A LARGE SEMITRANSPARENT BOUNDARY. David B. Beard. Feb. 27, 1959. 53p.

The cyclotron emission from a hot, completely ionized magnetically-confined plasma was estimated by computing the absorption of an incident plane wave. The harmonics of the fundamental cyclotron frequency, which are emitted perpendicular to the magnetic field direction, were summed over and also treated individually. Because of the Doppler effect and the relativistic variation in mass, the behavior of the electrons and the electromagnetic properties of the medium are functions of electron velocity. Assuming a Maxwell-Boltzmann distribution in electron velocity, the polarization of the plasma was computed by integrating over electron velocity. Solution of Maxwell's equations yielded the absorption of an incident wave, and thus, from Kirchhoff's relation, the emission of the plasma was determined. The entire calculation was carried out non-relativistically to first order in v^2/c^2 and at temperatures below those where fluctuations are important. The emission was found to depend inversely on the temperature. The emission perpendicular to the confining magnetic field is much less than the collision bremsstrahlung for sufficiently high temperature of several tens of kilovolts, depending on the plasma dimensions, density, and magnetic field shape. (auth)

21322 NAA-SR-3719

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

GRACE I—AN IBM 704-709 PROGRAM DESIGNED FOR COMPUTING GAMMA-RAY ATTENUATION AND HEATING IN REACTOR SHIELDS. D. S. Duncan and A. B. Speir. June 30, 1959. 54p. Contract AT-11-1-GEN-8. $1.50(OTS).

GRACE I is a multigroup, multiregion, gamma-ray attenuation code written in the FORTRAN System for either the IBM 704 with an 8000 word minimum storage capacity or the IBM 709. The code was designed primarily for computing gamma-ray heating and gamma-ray dose rates in multiregion finite or semi-infinite slab shields. The buildup factor is represented analytically by a double exponential expression of the form suggested by Taylor. The contribution to the total flux distribution at any particular location in the shield from a given source region is computed using a single material buildup factor. If desired, however, a different buildup factor may be specified for each source region considered. As many as 30 regions, 10 mesh points per region, 20 gamma-ray energy groups, 10 shield materials, and 5 material buildup factors may be included in a single calculation. In any region, either a uniform or an exponential source distribution may be specified. (auth)

21323 NAA-SR-Memo-4189

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

LEAST SQUARES ANALYSES OF AXIAL NEUTRON FLUX DISTRIBUTION IN EXPONENTIAL ASSEMBLIES. G. W. Rodeback. July 27, 1959. 7p. $1.80(ph), $1.80 (mf) OTS.

Given a plane source of primarily thermal neutrons at one end of an "exponential" assembly, the thermal neutron flux is assumed to have a hyperbolic sine distribution in the direction perpendicular to the plane source over an appreciable portion of the perpendicular length of the assembly. The general method used to give a least square fit of data to the sinh function is outlined. Certain assumptions are made regarding the experimental uncertainties of the data. The least squares analysis which results from these assumptions is indicated. A code for the IBM 709 was prepared which carries out the above least squares analysis. The required input data and the printed results of the IBM 709 computation are briefly outlined. (auth)

21324 NASA-TR-R-32

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

TABLES OF THE BESSEL-KELVIN FUNCTIONS Ber, Bei, Ker, Kei, AND THEIR DERIVATIVES FOR THE ARGUMENT RANGE 0(0.01)107.50. Herman H. Lowell. 1959. 303p.

Self-checking digital and tabulating equipment was used for calculation of the tables. For ber, bei, ber', and bei', the number of significant figures is either 13 or 14 for the two absolutely larger functions but is generally less for the remaining two. For ker, etc., the number of significant figures varies from a minimum of 9 for the absolutely largest function at arguments near 9 to a maximum of 14 elsewhere; 13 or 14 is achieved for all arguments greater than 14. The number of significant figures for the remaining three functions of the second kind is in general less at a given argument than for the absolutely largest function. (auth)

21325 NP-7897

California Inst. of Tech., Pasadena. Electron Tube and Microwave Lab.

EXPERIMENTS ON THE INTERACTION OF A MODULATED ELECTRON BEAM WITH A PLASMA. Technical Report No. 11. Gary D. Boyd. May 1959. 110p. Contract Nonr-220(13).

Experiments were performed on the high frequency interactions of electron beams and plasmas. A modulated electron beam is passed through a uniform plasma region of a mercury arc discharge, after which it is demodulated. Exponentially growing wave amplification along the electron beam is observed for the first time at a modulation frequency equal to the plasma frequency. No constant magnetic fields were used in the experiments. Calculations based on the one dimensional analysis of Bohm and Gross of an electron beam passing through a plasma are made to predict the effects of the random energy of the plasma electrons and collisions. By studying the interaction of a finite diameter beam and a plasma with no thermals or collisions, it is shown that the effect of the finite geometry is to reduce the growth constant. (auth)

21326 NP-7913

Stanford Research Inst., Menlo Park, Calif.

RESEARCH ON COLLISION PROCESSES OF ELECTRONS AND ATOMS. Annual Report. James R. Peterson, Otto Heinz, and Charles J. Cook. July 31, 1959. 42p. SRI Project No. SU-2557. Contract Nonr-2588(00).

An apparatus for use in experimental studies of low-energy particle impact phenomena is described. Investigation of collisions between electrons and ionized or neutral atoms or molecules will employ crossed-beam techniques, using modulated beams and phase-sensitive detection. The approach represents a departure from conventional atomic beam methods in that

the atoms are obtained from a fast ion beam rather than from a thermal source. An analysis of the application of the method to the determination of electron-atom ionization cross sections demonstrates the feasibility of the method. (auth)

21327 NYO-2411
Princeton Univ., N. J. Project Matterhorn.
ECONOMIC PRODUCTION OF PULSED D. C. POWER. A Proposal of (1) Methods of High Utilization of Flywheel Energy (2) High Output Pulsed D. C. Generators. Technical Memorandum No. 14. Robert G. Mills. Jan. 20, 1955. 18p. $3.30(ph), $2.40(mf) OTS.

The problem of producing large amounts of d-c power (100,000 kw) for brief periods of the order of 3 seconds with a duty cycle of about 1% is considered. Since a conventional d-c generator cannot produce full rated voltage at less than rated speed, the speed change of a conventional machine in pulsed operation must be kept small, and the flywheel must store much more energy than that required in the pulse. Two methods of abstracting most of the flywheel energy per pulse are discussed in detail. (W.D.M.)

21328 ORNL-2772
Oak Ridge National Lab., Tenn.
MASS SPECTROMETRIC STUDY OF THE VAPOR STATE OF SILVER HALIDES. H. M. Rosenstock, J. R. Walton, and L. K. Brice, Jr. Sept. 30, 1959. 12p. Contract W-7405-eng-26. $0.50(OTS).

The mass spectra of AgCl, AgBr, and AgI vapor have been studied. All show evidence of trimeric vapor species. The heat of trimerization of AgCl was determined as 110 ± 20 kcal/mole. The ratios of heats of activation for vaporization were measured for various vapor species in LiBr, LiI, NaCl, KCl, and KI. The results for LiBr, LiI, and NaCl are in agreement with values determined by equilibrium thermochemical methods. The results for KI are in marked disagreement with measurements by effusion cell methods. Possible reasons for the discrepancy are discussed. (auth)

21329 ORNL-2779
Oak Ridge National Lab., Tenn.
THE FAST-NEUTRON MULTIPLICATION EFFECT OF BERYLLIUM IN REACTORS. W. Hafele. Sept. 22, 1959. 37p. Contract W-7405-eng-26. $1.25(OTS).

The fast multiplication effect of beryllium, which is due to the (n,2n) reaction, is considered. To this end a review of the available information on this effect and on the relevant cross section data is given. Based on this information, an upper and a lower estimate of the (n,2n) cross section is given. To compute the fast multiplication effect the spectrum in an infinite homogeneous beryllium moderator is calculated supposing that the source neutrons have a fission neutron distribution. The whole angular distribution of the elastically scattered neutrons is taken into account. The upper limit of the net multiplication effect is 7.6%, the lower limit 5.1%. Attention is given to the poisoning effect which is created by the daughter products of the (n,α) reaction. At fluxes of about 5×10^{13} n/cm^2 sec it lowers the reactivity gain by about 5% after about two years. (auth)

21330 SC-1803(TR)
Sandia Corp., Albuquerque, N. Mex.
SOME TESTS OF THE DIFFRACTION OF BLAST WAVES. Melvin L. Merritt. June 7, 1951. 78p. $12.30(ph), $4.50(mf) OTS.

A series of tests was conducted to measure the diffraction about a structure of shock waves from the detonation of high explosives. Two simple geometrically similar structures were used for the tests, each subject to blast waves of two different overpressures and two different durations. Pressure loadings during passage of the shock wave are presented and conclusions drawn from these data. An investigation of the effects of changes in overpressure alone would indicate that diffraction at one pressure is not necessarily similar to diffraction at another. (auth)

21331 SC-2278(TR)
Sandia Corp., Albuquerque, N. Mex.
PRELIMINARY REPORT ON MEASUREMENT OF SOIL STRESSES CAUSED BY AN UNDERGROUND EXPLOSION. William R. Perret. Mar. 17, 1952. Changed from OFFICIAL USE ONLY Apr. 12, 1956. 18p. $3.30(ph), $2.40(mf) OTS.

The procedures followed in placing gages and data analysis for test HE-3 underground explosion are discussed. The type and reliability of best results are indicated. It is concluded that principal stresses caused by such explosions may be derived from these data. (J.R.D.)

21332 SCTM-94-54(51)
Sandia Corp., Albuquerque, N. Mex.
MOTION SHADOWGRAPHS OF SHOCK WAVES. Jay Todd, Jr. and Warren S. Roberts. May 28, 1954. 5p. $1.80(ph), $1.80(mf) OTS.

A method is presented for making shock shadowgraphs by means of a Fastax motion picture camera. Two examples of strip pictures taken from research investigations now under way are shown. (auth)

21333 SCTM-178-55(52)
Sandia Corp., Albuquerque, N. Mex.
FORECAST VERIFICATION, RECENT FORECASTING DEVELOPMENTS AND PROJECTS. Albert T. Marrs. Aug. 19, 1955. 8p. $1.80(ph), $1.80(mf) OTS.

The operational forecasting of the meteorological section 5243-2 for various test ranges is made on a go-no go basis. Stringent values of the meteorological parameters have been selected above and below which operations generally are or are not possible. A forecast verifies correctly on this basis only when all individual elements have been properly predicted. To improve forecast quality, various new cirrus cloud, visibility, and surface wind forecasting techniques are being investigated. Coupled with this is the initiation of a completely automatic weather instrumentation program for the ranges to permit continuous observations regardless of the presence of operating personnel. (auth)

21334 SCTM-187-59(51)
Sandia Corp., Albuquerque, N. Mex.
AN IMPACT STUDY OF FERROELECTRIC BARIUM TITANATE. R. A. Graham. July 1, 1959. 42p. $7.80(ph), $3.30(mf) OTS.

The behavior of ceramic barium titanate is studied under the conditions associated with the impact of a projectile moving at velocities of 75 to 650 feet per second. A partially electroded specimen is used to show the correlation between the passage of stress waves in the normal mode and the charge released under open-circuit conditions. The elastic wave is found to move at the dilatational wave velocity predicted on the basis of elastic constants determined under low signal conditions. Strong evidence is found for the existence of a plastic wave in the barium titanate. Evidence is also found for a very high electromechanical coupling in the plastic wave. (auth)

21335 SCTM-215-59(51)
Sandia Corp., Albuquerque, N. Mex.
TABULATION OF THE HYPERGEOMETRIC PROBABILITY DISTRIBUTION FOR LOT SIZES LESS THAN OR EQUAL TO 50. D. B. Owen. Aug. 13, 1959. 31p. $6.30(ph), $3.00(mf) OTS.

A tabulation (too large to be included in the memorandum) of the hypergeometric probability distribution for lot sizes up to and including 50 is described. Uses of the tabulation in sampling inspection and reliability are described. The tabulation provides a simple way of testing the equality of two proportions when the total number of observations on the proportions does not exceed 50. (auth)

21336 SCTM-255-59(14)
Sandia Corp., Albuquerque, N. Mex.
IMPEDANCE OF A DIPOLE IN AN IONIZED MEDIUM—II. Charles W. Harrison, Jr., and David H. Denton, Jr. July 7, 1959. 22p. $4.80(ph), $2.70(mf) OTS.

A method of calculating the impedance of a dipole within an ionized medium of low attenuation is presented. This report may be regarded as a continuation of the writers' memorandum bearing the same title, which presents an alternative, but possibly more complicated, solution of the problem. Essentially the same approximations are made in both treatments of the subject. (auth)

21337 SCTM-264-59(51)
Sandia Corp., Albuquerque, N. Mex.
THE AVERAGE NUMBER OF TRIALS UNTIL A PATTERN APPEARS; AN APPLICATION OF RECURRENCE THEORY. E. J. Gilbert. Aug. 10, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

In a production process which has constant probability of producing good items independently from item to item, it may be desired to stop production, stop testing, or take some other action, whenever a given pattern of occurrences of good and bad items first appears. The method of recurrent events is used to develop equations which give the average number of trials and the probability distribution of the number of trials, until the pattern first appears. Some approximations to the exact solutions are discussed. (auth)

21338 TID-3079
Technical Information Service Extension, AEC.
INDUSTRIAL USES OF ISOTOPES, CHEMICAL REACTION MECHANISMS AND KINETICS, AND RADIOCHEMISTRY. A Selected List of References. J. A. McCormick, comp. Sept. 1959. 87p. $2.25(OTS).

This bibliography contains 417 annotated references on uses of isotopes in industry and in chemical reaction mechanisms and kinetics. The references were taken from the 1957 to 1958 open literature. Also included are a list of journals from which the references were selected, an author index, an isotope index, and a graphical depiction of typical applications. (auth)

21339 UCRL-3816(Rev.)
California. Univ., Berkeley. Lawrence Radiation Lab.
A METHOD FOR MINIMIZING A FUNCTION OF n VARIABLES. William A. Nierenberg. Aug. 1959. 8p. Contract W-7405-eng-48. $0.50(OTS).

This is a method for finding the minimum of a function of an arbitrary number of variables by a series of successive approximations using a paraboloidal fit. The method is particularly suited for computer programming if a matrix inverting routine is available. (auth)

21340 UCRL-5601
California. Univ., Livermore. Lawrence Radiation Lab.
SOLUTIONS OF SYSTEMS OF DIFFERENTIAL EQUATIONS. Roy L. Clay. June 1959. 18p. Contract W-7405-eng-48. $0.75(OTS).

FOLDER is a routine whose purpose is to solve a system of linear differential equations on the IBM 650 computer which is equipped with index accumulators and floating-point hardware. A system of K n^{th}-order differential equations which is represented by a system of $K \times n$ first-order differential equations and coded in a prescribed manner is solved numerically by the methods of Milne and/or Runge-Kutta. Flexible operating modes are made possible by the user's designation of parameters. Output data and format are under complete control of the user. (auth)

21341 UCRL-8523(Rev.)
California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Livermore. Lawrence Radiation Lab.
A PRACTICAL GUIDE TO THE METHOD OF LEAST SQUARES. Peter Cziffra and Michael J. Moravcsik. June 5, 1959. 25p. Contract W-7405-eng-48. $0.75 (OTS).

This report, a revised and corrected version of UCRL-8523, gives a short and practical summary of curve fitting by the method of least squares. The purpose is to list and roughly justify the formulas used in finding the best fitting curve, the errors, and the quantities which describe the goodness of the fit. (auth)

21342 UCRL-8667
California. Univ., Berkeley. Lawrence Radiation Lab.
STUDIES ON THE CONDUCTIVITIES OF DISPERSIONS (thesis). Robert Eugene Meredith. July 1959. 134p. Contract W-7405-eng-48. $2.75(OTS).

The conductivities of dispersions are studied theoretically and experimentally. Data on foams, emulsions, and mixtures of solids in liquids indicate that the dilute suspension relations are not obeyed above a dispersed-phase volume fraction of about 0.2. A review of previous attempts at predicting the behavior of the data at higher concentrations reveals need for improvement both in regards to experimental accuracy and theory. Electrical-conductivity data on emulsions are presented where the conductivities of the two phases vary over a wide range and where the volume fraction of the dispersed phase extends up to 0.6. In addition, measurements are made on dispersions of ordered arrangements of spheres and cylinders. Theoretical developments are presented following three different methods of attack. The mathematical technique used by Bruggeman for dispersions of spheres is employed to develop an expression that is valid for dispersions of spheroidal particles. A new approximation (distribution model) is proposed for treating a concentrated dispersion of spherical and nonspherical particles. The resulting expression is in good agreement with measurements on spheroidal particles over the entire range of concentrations. The Rayleigh equation for the conductivity of a cubical lattice of spheres is redeveloped by using a different potential function and considering higher terms. (auth)

21343 UCRL-8802
California. Univ., Berkeley. Lawrence Radiation Lab.
TABULATION OF POTENTIAL FUNCTIONS AND DYNAMIC CORRECTION TERMS FOR THE HYDROGEN MOLECULAR ION. Stanley Cohen, David L. Judd, and

Robert J. Riddell, Jr. June 18, 1959. 44p. Contract W-7405-eng-48. $1.25(OTS).

Potential functions and first-order dynamic correction terms for the generalized hydrogen molecular ion are tabulated. A brief discussion of the meaning of the various functions is included. (auth)

21344 USNRDL-TR-327

Naval Radiological Defense Lab., San Francisco.
THE TOTAL HEMISPHERICAL EMISSIVITY OF METALS. C. P. Butler and E. C. Y. Inn. May 28, 1959. 19p.

A direct method was developed for the measurement of total hemispherical emissivity from 1000°C to less than ambient by using the arc image furnace for heating. The results for polished platinum and copper show that the total hemispherical emissivity is much higher than the total normal emissivity for these metals. In the case of copper, its prior heat treatment was effective in stabilizing its total hemispherical emissivity. (auth)

21345 AEC-tr-3713

MEASUREMENT OF PLASMA TEMPERATURE AND ION DENSITY. Kiyoshi Murakawa and Shizuyo Mizuno. Translated for Oak Ridge National Lab. from Bull. Aeronaut. Research Inst., Univ. Tokyo 1, 153-63(1958). 25p. (Includes original, 11p.). $4.80(ph), $2.70(mf) JCL.

The object of this investigation is to measure the temperature of the plasma obtained by passing a condensed discharge through a Geisler tube (the inner diameter of the capillary being about 3 mm) containing neon of approximately 5 mm Hg pressure. The wave length of the line Ne I λ 5852 emitted from this light source was compared with that of the same line emitted from an arc discharge passing through the same Geisler tube. The comparison was made by means of a silvered Fabry-Pérot etaon, and the line profile was studied by means of a microphotometer. It was found that the line Ne I λ 5852 emitted from the condensed discharge was displaced to the smaller frequency side as compared with the same line emitted from an arc discharge. This is interpreted to be due to the quadratic Stark effect caused by the ionized neon atoms and electrons in the plasma, the line emitted from the arc discharge being assumed to suffer negligible Stark effect. The amount of displacement gives directly the value of the most probable electric field intensity that is given by Holtsmark's theory of line broadening. The contribution from the fluctuation of the electric field to the line breadth (neglecting the Doppler effect) can then be calculated. When this is subtracted from the observed line breadth, the remaining breadth is interpreted to be due to the Doppler effect, and the plasma temperature can be calculated by the usual formula of Doppler effect. From the most probable value of the electric field intensity Holtsmark's so-called normal field strength (Normalfeldstfrke) F_n can be calculated. If we assume that there are only singly ionized atoms (in addition to the neutral atoms) present, the ion density can be approximately calculated from the value of F_n, although this assumption is not altogether correct. In the condensed discharge the discharge current is not constant but varies with time. The line profile of Ne I λ 5852 (obtained in the present study) is therefore a mean profile, in which the mean is taken over the time, the intensity of λ 5852 at each instant being the weight. The obtained plasma temperature is the mean temperature deduced from this "mean" profile. Even if we assume a strict validity of Holtsmark theory, the contribution of the fluctuation of the electric field intensity to the line breadth that was calculated in the present study does not have an altogether strict physical meaning. In our present example the mean plasma temperature was $T = 2.2 \times 10^3$ K, and the ion density $N = 7 \times 10^{16}$ per cm^3. (auth)

21346 AEC-tr-3778

INFLUENCE ON CONCENTRATION OF THE ADMIXTURE ON THE QUANTUM YIELD OF LUMINESCENCE DEPENDENT ON THE THICKNESS OF ANTHRACENE CRYSTALS. A. N. Faidysh and V. L. Zima. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 6, 98-101(1959). 8p. $1.80 (ph), $1.80(mf) JCL or LC.

The effects of naphthacene concentration on the luminescence of anthracene crystals were investigated. The concentrations of naphthacene in the samples were 3×10^{-6}, 8×10^{-6}, 3×10^{-5}, and 10^{-4} mole mole anthracene. Results are presented graphically. (J.R.D.)

21347 AEC-tr-3781

THE EFFECT OF PHYSICAL STRUCTURE AND STATE OF AGGREGATION ON THE SENSITIVITY OF EXPLOSIVES. A. Ya. Apin and V. K. Bobolev. Translated for Los Alamos Scientific Lab. from Zhur. Fiz. Khim. 20, 1367-71(1946). 4p. $1.80(ph), $1.80(mf) JCL or LC.

The characteristics of explosives are examined, and a mechanism for detonation propagation is presented. According to this mechanism, a detonation is propagated in powder-form explosives by means of hot reaction gas jets penetrating air spaces and igniting the particles. In a continuous medium the hot gas jets penetrate directly and ignite the medium at points of penetration. The chemical reaction on the detonation front proceeds in the form of combustion. The combustion surface depends on resistance to the gas jets. (J.R.D.)

21348 AEC-tr-3784

ELECTRICAL INVESTIGATIONS WITH OXIDE SEMICONDUCTORS. (Elektrische Untersuchungen an Oxydischen Halbleitern.) Werner Hartmann. Translated for Oak Ridge National Lab. from Z. Physik 102, 709-33(1936) 63p. (Includes original, 25p.). $7.80 (ph), $3.30(mf) JCL.

The conductivity of Al_2O_3, Ta_2O_5, UO_2, and CuO_2 was investigated. The aluminum and tantalum oxides exhibit a reduction semiconductance, i.e., their resistance increases with increasing O content. Measurement of the Hall effect in UO_2 revealed a hole conductance in that compound. A negative Hall constant was found in CuO_2. (J.R.D.)

21349 AEC-tr-3824

THE ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF HYDROGEN ATOMS STABILIZED ON SOLID SURFACES. N. N. Bubnov, V. V. Voevodskii, L. S. Polyak, and Yu. D. Tsvetkov. Translated for Argonne National Lab. from Optika i Spektroskopiya 6, 565-6(1959). 2p. $1.80(ph), $1.80(mf) JCL or LC.

Surface effects on the magnitude of the hyperfine splitting in the electron paramagnetic resonance (EMR) of H atoms and the EMR spectra of H atoms stabilized on quartz, silica gel, and molybdenum glass were examined. The hyperfine splitting magnitude was found to be about 500 oersteds. It was concluded that the binding of the H atoms to the surface must occur without significant change in the spin density of the un-

paired electron in the atom. Further study is necessary before the nature of the binding can be absolutely established. (J.R.D.)

21350 AEC-tr-3835
STUDIES ON THERMOELEMENTS FROM THE RHENIUM–IRIDIUM SYSTEM. G. Haase and G. Schneider. Translated from Z. Physik 144, 256-62(1956). 7p. $1.80(ph), $1.80(mf) JCL.

The thermoelectric current generated in Ir and Re and alloys of these were measured at 100 to 2450°C. The most suitable thermocouple appears to be 70% Re. (J.R.D.)

21351 AEC-tr-3839
THE SEPARATION NOZZLE. II. THE PHYSICAL BASES AND THE SPECIFIC MAGNITUDES OF THE EXPENDITURES OF THE PROCESS. E. W. Becker, W. Beyrich, K. Bier, H. Burghoff, and F. Zigan. Translated by E. Von Halle from Z. Naturforsch. 12a, 609-21(1957). 31p. $6.30(ph), $3.00(mf) JCL.

A gas and isotope separation process based on the partial spatial separation of heavy gases in an expanding supersonic stream were investigated. The influence of the nozzle shape and gas pressure on the stream expansion, and on the magnitude and spatial character of the separation was determined. It is shown that the characteristics of the separation effect may be explained by certain aspects of diffusion. A systematic analysis of the specific magnitudes of process expenditures was used to determine the most favorable operating conditions of a separation nozzle cascade. (J.R.D.)

21352 NP-tr-277(Pt. I)
THEORY OF IONIZATION IN COLUMNS. [PART] I. G. Jaffé. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Ann. Physik (4) 42, 303-44(1913). 50p. $7.80(ph), $3.30 (mf) JCL.

An equation was developed for the time and space changes in ionization density in a column, with allowances for diffusion and recombination. The values for the diffusion loss in various gases and liquids calculated by the theory agree with experimental results. Equations were developed for the processes in a column in an electrical field, for any direction of the field relative to the column. The saturation curves deduced from the theory agree with the experiment: for gases under normal pressure, ionized by α particles; for gases under high pressure, ionized with β particles; and for hexane, ionized with α and β particles. The diameter of a column produced by an alpha particle proves to be proportional to the range of the alpha rays in various media. The saturation curve can be predicted for any medium, gaseous or liquid. (W.L.H.)

21353 NP-tr-280
NON-STATIONARY THEORY OF THE STARK BROADENING OF SPECTRAL LINES IN A PLASMA. L. A. Vaĭnshteĭn and I. I. Sobel'man. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment, Harwell) from Optika i Spektroskopiya 6, 440-6 (1959). 15p. $3.30(ph), $2.40(mf) JCL.

The broadening of atomic lines by charged particles is considered in a non-adiabatic approximation. This allows for derivation of several new results while retaining a comparatively simple quasi-classical model. At the velocities of plasma electrons the Weisskopf broadening mechanism is unimportant, and the broadening is due to inelastic processes. It is shown that the width and shift of the lines decrease approximately as $1/\sigma$ at high velocities, and ions therefore become increasingly important. The line shift is almost entirely due to ions over a wide range of temperatures. The plasma parameters can often be determined more easily from the line shift than from its width. (auth)

21354 SCL-T-268
TEMPERATURE AND ELECTRON DENSITY IN A WATER-STABILIZED LIGHT ARC. (Temperatur und Elektronendichte in einem wasserstabilierten Lichtbogen.) G. Jürgens. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. Physik 134, 21-41(1952). 20p. $3.30(ph), $2.40(mf) JCL.

Investigations disclose that H_{beta}, as well as the remaining spectrum, are emitted in both radiation directions from optically thin strata. A theoretical profile of the Balmer lines is given, and an equation for the absolute intensity of the lines is determined. A mean temperature of 12615 ± 280°K was determined with an optically thick layer. The electron density for the Balmer series was estimated as being 4 to 8×10^{16} cm^{-3}. (C.J.G.)

21355 TT-820
THE HISTORY OF THE "RÖNTGEN" AND THE POSSIBILITIES OF ITS FURTHER DEVELOPMENT. (Zur Geschichte der Einheit "Röntgen" und der Möglichkeiten ihrer Weiterentwicklung.) H. Holthusen. Translated by D. A. Sinclair (National Research Council of Canada) from Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 89, 746-52(1958). 14p.

The history of the roentgen and the possibilities of its further development and use in x-ray dosimetry are discussed. (C.H.)

21356 TT-823
FUNDAMENTAL PROBLEMS OF X-RAY DOSIMETRY. (Grundfragen der Röntgenstrahlen-Dosimetrie.) R. Glocker. Translated by D. A. Sinclair (National Research Council of Canada) from Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 90, 101-9(1959). 19p.

Fundamental problems of x-ray dosimetry are discussed. (C.H.)

21357 UCRL-Trans-491
VOLTAGE CHARGES IN MULTIPHASE CURRENT NETWORKS WITH A PULSED CONVERTER LOAD. (Zur Frage der Spannungsanderungen in Drehstromnetzen bei Stossweiser Stromrichterbelastung.) Gottfried Möltgen. Translated by Richard B. Mudge (Univ. of Calif. Lawrence Radiation Lab.) from Elektrotech. Z. 80A, 175-80(1959). 27p. (Includes original, 6p.). $4.80(ph), $2.70(mf) JCL.

A system of curves is presented with which it is relatively simple to estimate the voltage changes in multiphase current networks with pulsed converter loads. (W.D.M.)

21358

INTEGRAL EQUATIONS FOR THE SCHRÖDINGER WAVE FUNCTION. W. Tobocman (Rice Inst., Houston, Tex.) and L. L. Foldy (Case Inst. of Tech., Cleveland). Am. J. Phys. 27, 483-90(1959) Oct.

The transformation of the Schroedinger equation from differential form to integral form by two methods is described; one appropriate to bound-state theory and one appropriate to scattering theory. It is shown that the bound-state wave function is also a solution of the integral equation (Lippman-Schwinger equation) appropriate to scattering theory. (auth)

21359

ENERGY MOMENT METHOD IN QUANTUM MECHANICS. Paul M. Parker (Michigan State Univ., East Lansing) and L. Carlton Brown (Ohio State Univ., Columbus, Ohio). Am. J. Phys. 27, 509-14(1959) Oct.

The procedure relates the physical parameters associated with the description of a quantum mechanical system to energy eigenvalues of the wave equation of the system in such a manner that for relatively simple systems the physical parameters can be evaluated from experimental data without effecting a detailed solution for the roots of the secular equation. Results of the application of the energy moment method to two particular physical systems are included. (auth)

21360

A DYNAMIC NUCLEUS OF THERMO-ELASTIC STRAIN IN AN ELASTIC INFINITE SPACE AND SEMI-SPACE. J. Ignaczak. Bull. acad. polon. sci., Sér. sci. tech. 7, 305-8(1959).

A dynamic nucleus of thermo-elastic strain is introduced enabling the solution of the equations of motion of thermo-elasticity for any temperature field depending also on time. This solution may also be used to obtain the stress waves due to sudden heating of the boundary of the elastic semi-space. (C.J.G.)

21361

FACTORS INFLUENCING CORROSION. G. V. Akimov. Corrosion 15, 455t-68t(1959) Sept.

External and internal factors influencing the rate and distribution of corrosion are discussed. Among the external factors considered are: pH of the solution, influence of elements acting as inhibitors or as stimulants of corrosion, the concentration of neutral salts, the temperature of solution, and the rate of solution movement. Corrosion damage caused by stray electric currents is described in detail and measures eliminating or minimizing their effect are suggested. Internal factors considered include the inherent chemical properties of elements (that is, their position in periodic table). However, a distinction is made between chemical and corrosion stability, because of the possible formation of protective films. Furthermore, the influence of internal stresses as well as of alternating stresses in metals in corrosive media (corrosion fatigue) is described. Surface conditions influencing corrosion are mentioned. Stability of monophasic and of heterophasic alloys and the influence of grain size on corrosion are discussed. Finally, experimental data on stability limits of solid solutions and related phenomena such as dezincification are given and some attempts at the explanation of stability limits of solid solutions are mentioned. (auth)

21362

NON-STATIONARY PROBLEM OF MAGNETIC HYDRODYNAMICS FOR THE SEMISPACE. S. A. Regirer (Obruchev Inst. of Permafrost, The Northern Section of the Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 983-6(1959) Aug. (In Russian)

Problems of non-stationary single-dimensional flow of viscous liquid in semispace were previously studied within the frame work of classic hydrodynamics. Analogous studies are made of the viscous electroconducting liquid in magnetic field. (R.V.J.)

21363

HIGH RESOLUTION SPECTROSCOPY. PART A. PRINCIPLES AND PRACTICES IN HIGH RESOLUTION SPECTROSCOPY. PART B. SPECTROSCOPIC RESEARCH. J. R. McNally, Jr. (Oak Ridge National Lab., Tenn.). Eng. Prog. Univ. Florida 12, No. 11, Bull. Ser. No. 100, 5-23(1958) Nov.

Resolution limitations both in the source and in instrumental techniques are discussed. These limitations include the effects of pressure, Doppler and magnetic broadening, self-absorption, photographic grain effects, molecular dissociations, and accelerating fields. Operation and use of the hollow-cathode source, a water cooling device for the cathode, and electrodeless discharge tube, a magnet for Zeeman effect studies, and an echelle spectrograph are given. A design is also given for a pressure-scanning interferometer. The origin of some of the line-broadening effects and the use of some of those effects which are inherent to the atom itself, are discussed. These effects include Zeeman effects, quadrupole or electrical effects, nuclear volume effects which contribute to the isotope shift of spectrum lines and the field of hyperfine structure. (C.J.G.)

21364

SPECIAL SPECTROCHEMICAL TECHNIQUES. B. TEMPERATURE MEASUREMENT IN SPECTROSCOPIC LIGHT SOURCES. Cyrus Feldman and Margaret K. Wittels (Oak Ridge National Lab., Tenn.). Eng. Prog. Univ. Florida 12, No. 11, Bull. Ser. No. 100, 36-49(1958) Nov.

Spectrochemical procedures are most effectively designed when information is available on the mechanism by which the sample is excited to luminescence and the relationships existing in the analytical gap between current, sample vapor, and atmosphere. Studies on the discharge obtained in air with the porous cap and similar thin-film solution excitation devices are reported. Thermal equilibrium exists in porous-cup discharges excited by d-c pulses approximately 600 to 900 μsec in duration and 5 to 10 amperes in peak-height. A technique is described for measuring the temperatures of such discharges by means of the ultraviolet OH bands, using a spectrograph of 2.5 A/mm dispersion. At solute concentrations of 0.25M or less, and under the described excitation conditions, the temperature of the discharge decreases linearly with distance from the porous cup electrode surface until a point approximately ⅔ of the distance across the gap is reached. The slope of the temperature vs. distance curve then becomes more positive. Increasing the gap width decreases the temperature gradient and the discharge temperature near both electrodes. The nature and concentration of the solute has considerable effect on the average discharge temperature in the 0 to 20 zone. The effect of a matrix element on the spectrum of a minor element is discussed. (C.J.G.)

21365

AN INVESTIGATION INTO THE MOMENTUM DISTRIBUTION IN LIGHT NUCLEI. C. M. Pujara and K. M. Gatha (Inst. of Science, Bombay). Indian J. Phys. 33, 243-62(1959) June.

The characteristic nuclear density distribution for light elements was obtained by Gatha and Shah. Using this density distribution, the nucleonic momentum distributions were obtained on the basis of the Thomas-Fermi-Weizsäcker method for carbon and oxygen. Using these momentum distributions the proton energy spectra, resulting from inelastic scattering at 30 and 40° of 340 Mev protons, were calculated. Using the momentum distribution for carbon, the production efficiencies and the meson energy spectra at 45, 90, and 135°, result-

ing from the photoproduction of mesons on carbon, were also calculated. (auth)

21366

STABLE AND METASTABLE EQUILIBRIA IN THE SYSTEMS $Y_2O_3-Al_2O_3$ AND $Gd_2O_3-Fe_2O_3$. I. Warshaw and Rustum Roy (Pennsylvania State Univ., University Park). J. Am. Chem. Soc. 42, 434-8(1959) Sept.

The phase equilibrium relations in the systems $Y_2O_3-Al_2O_3$ and $Gd_2O_3-Fe_2O_3$ were examined. Each system has two stable binary compounds. A 3:5 molar ratio garnet-type compound exists in both systems. The 1:1 distorted perovskite structure is stable in the system $Gd_2O_3-Fe_2O_3$ but only metastable in the system $Y_2O_3-Al_2O_3$. This interesting example of metastable formation and persistence of a compound with ions of high Z/r values explains the discrepancies in the literature on the structure of the composition $YAlO_3$. A new 2:1 molar ratio cubic phase has been found in the system $Y_2O_3-Al_2O_3$. Since silicon can be completely substituted for aluminum in this compound, the aluminum ions are presumably in fourfold coordination. (auth)

21367

ON SOME LIMITATIONS OF UPPER WIND RECORDS. B. N. Charles (Sandia Corp., Albuquerque, N. Mex.). J. Geophys. Research 64, 343-6(1959) Mar.

Some effects of low-elevation-angle terminations of electronic wind soundings are indicated by statistics from two climatological projects. These effects bias mean values, standard deviations, and inter-level correlations. Examples are given, and the suggestion made that the climatic record of upper winds be routinely augmented by interpolated synoptic values. (auth)

21368

RADIATION MEASUREMENTS TO 658,300 KM. WITH PIONEER IV. James A. Van Allen and Louis A. Frank (State Univ. of Iowa, Iowa City). Nature 184, 219-24 (1959) July 25.

The flight of deep-space probe Pioneer IV is described, and radiation observations obtained are reported and discussed in comparison with Pioneer III and the first Soviet cosmic rocket results. In particular, the discussion includes: paucity of energetic plasma in interplanetary space March 3-6, 1959, lack of influence of the moon, re-determination of interplanetary cosmic-ray intensity, effective extent of the geomagnetic field, and the terrestrial ring current of Dolginov and Pushkov. (T.R.H.)

21369

SEMICONDUCTORS AS RADIATION DETECTORS. G. I. Crawford (Plessey Nucleonics, Ltd., Northampton, Eng.). Nuclear Power 4, No. 40, 84-7(1959) Aug.

The most promising type of semiconductor for use as a radiation detector is an n-p junction in germanium or silicon, which may be preferable at higher temperature. Such a detector has a high intrinsic efficiency for the detection of charged particles and, with suitable coatings, may be used as a detector for fast or slow neutrons. For the detection of gamma radiation, cadmium sulfide crystals or polycrystalline layers are to be preferred. The principal advantage of these detectors lies in their small physical size which permits a spatial resolution at least as good as that obtainable with foil techniques, with the great advantage over foil techniques of providing a direct reading system. (auth)

21370

EXPERIMENTS ON DOPPLER BROADENING. Nuclear Power 4, No. 40, 92-3(1959) Aug.

Measurements were made of the change in effective cross-section of the various samples as a function of their temperature which, after application of certain corrections, led to values of the Doppler coefficient. The Doppler coefficient was calculated for thorium and uranium, assuming that the U^{235} cross-section is temperature independent and the effect due only to U^{238}. (C.J.G.)

21371

EVALUATION OF HEAT TRANSFER SURFACES FOR NUCLEAR BOILERS. PART 2. FINNED TUBING. B. G. Ediss and R. Bilsborough (Nuclear Power Plant Co. Ltd., [London]). Nuclear Power 4, No. 40, 95-8 (1959) Aug.

A calculation for power loss in tube length shows advantage of the finned tubing over straight tubing. The most favorable proportions of a fin are discussed. Efficiencies for various forms of extended surfaces are determined. The results of an economic survey are discussed. (C.J.G.)

21372

GALVANOMAGNETIC EFFECTS IN n-InSb AT LOW TEMPERATURES IN STRONG MAGNETIC FIELDS. J. C. Haslett and W. F. Love (Univ. of Colorado, Boulder). Phys. and Chem. Solids 8, 518-23(1959) Jan.

Data are given for three separate ingots of n-InSb with excess donor concentrations of 1.2×10^{16}, 1.4×10^{15}, and 2.8×10^{14} cm^{-3}. The samples had dimensions of the order of $1 \times 1 \times 5$ mm. Separate current and potential or Hall leads were soldered to the samples with indium solder. (W.D.M.)

21373

HALL EFFECT IN COPPER AND Cu_3Au AT LOW TEMPERATURES. W. F. Love (Univ. of Colorado, Boulder). Phys. and Chem. Solids 9, 281-4(1959) Mar.

The Hall coefficient in single crystals of copper and Cu_3Au in the ordered and disordered states was measured at temperatures down to 4°K. No dependence of the Hall coefficient on orientation in copper was found. In all cases the Hall coefficient is found to be appreciably temperature-dependent. (auth)

21374

THE EFFECT OF PRESSURE ON THE NEAR-ULTRAVIOLET SPECTRA OF SOME FUSED-RING AROMATIC CRYSTALS. S. Wiederhorn and H. G. Drickamer (Univ. of Illinois, Urbana). Phys. and Chem. Solids 9, 330-4 (1959) Mar.

The effect of pressure was studied on the near-ultraviolet and visible absorption peaks of anthracene, phenanthrene, (a, h) dibenzanthracene, and (α) benzanthracene. In general, the effect of pressure is to shift the peaks to the red (lower energy) and to broaden them. The greater shift and broadening were found, in general, for the peaks with the larger transition moments. The total shift cannot be accounted for by the increase in density if only dipole–dipole interactions are considered. There seems to be no measurable increase in integrated intensity, and therefore no increase in transition moment. The most likely cause of the shift (in addition to the dipole–dipole interaction) is increased importance of quadrupole and higher interactions at high pressures. (auth)

21375

ANTIPHASE ANTIFERROMAGNETIC STRUCTURE OF CHROMIUM. L. M. Corliss and J. M. Hastings (Brookhaven National Lab., Upton, N. Y.) and R. J. Weiss

(Watertown Arsenal, Mass.). Phys. Rev. Letters 3, 211-12(1959) Sept. 1.

In the course of a neutron diffraction study of single crystals of Cr grown by the strain-anneal method it was observed that the antiferromagnetic superstructure reflections exhibited characteristic splittings. An analysis of these splittings led to an interpretation in terms of an antiphase antiferromagnetic domain structure. From the experimental observations, the intensity distribution in reciprocal space was deduced. From the integrated intensities of the magnetic superstructure peaks (100), (111), and (210), the Bohr magneton number was found to be 0.4 ± 0.05. (W.D.M.)

21376

TIME-DEPENDENT PAIR CORRELATIONS IN LIQUID LEAD. B. N. Brockhouse and N. K. Pope (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. Letters 3, 259-62(1959) Sept. 15.

Van Hove has proposed that the atomic motions in liquids can be studied in terms of a time-dependent pair correlation function, obtainable by Fourier transformation of neutron scattering measurements over the neutron energy and momentum. This pair correlation function $G(\bar{r},t)$ is the average number density at the point $\bar{r}$ at the time t, when it is known that there was an atom at the origin at time O. The first experimental determination of $G(\bar{r},t)$ for a simple liquid is presented. Liquid lead at 620°K was used. (W.D.M.)

21377

THERMAL DIFFUSION OF XENON AT TRACER CONCENTRATIONS. D. Heymann and J. Kistemaker (Laboratorium voor Massaspectrografie, Amsterdam). Physica 25, 556-68(1959) July.

A "two-bulb technique" was applied to measure thermal diffusion factors of the systems Xe–He, $Xe-H_2$, $Xe-D_2$, Xe–Ne, $Xe-N_2$, and Xe–Ar in the temperature range 300 to 700°K. Radioactive Xe^{133} was used as a tracer. Experimental results show that the quantitative agreement between theory, (the Lennard-Jones 6-12 model and appropriate force constants) and experiment is good. In the case of $Xe-H_2$, $Xe-D_2$, and $Xe-N_2$ the measured thermal diffusion factor is larger than the predicted thermal diffusion factor by 5 to 10%. The limiting value of R_T is about 0.50 for our systems which is definitely smaller than R_T values of 0.65 that have been previously measured in equimolar mixtures of Xe–He, Xe–Ne, and Xe–Ar. The accuracy of our measurements is mainly limited by the corrections implied in the Geiger-Mueller counting technique and is of the order of 5%. (auth)

21378

MUTUAL DIFFUSION OF BINARY MIXTURES OF HELIUM, ARGON AND XENON AT DIFFERENT TEMPERATURES. K. P. Srivastava (Indian Association for the Cultivation of Science, Calcutta). Physica 25, 571-8 (1959) July.

The coefficient of mutual diffusion of the binary gas mixtures Ar–He, Ar–Xe, and He–Xe has been determined at 0, 15, 30, and 45°C by allowing the diffusion to take place between two bulbs through a precision capillary tube. A differential conductivity analyzer has been used to analyze the samples of the gas withdrawn from one of the bulbs at different times. These experimentally determined diffusion coefficients have been utilized for calculating the unlike potential parameters ϵ_{12}/k and σ_{12} on the Lennard-Jones 12:6 model and compared with the values obtained previously from thermal diffusion data and also from the usual combination rules. The agreement seems to be quite satisfactory. These experimentally determined values of ϵ_{12}/k and σ_{12} have been further used for calculating D_{12} and are found to reproduce the experimental data satisfactorily. (auth)

21379

THE OPERATION OF LANGMUIR PROBES IN ELECTRONEGATIVE PLASMAS. R. L. F. Boyd and J. B. Thompson (University College, London). Proc. Roy. Soc. (London) A252, 102-19(1959) Aug. 25.

A criterion that must be satisfied by the positive-ion energy distribution at the edge of a sheath surrounding a negative probe is derived for the case when negative ions are present. This criterion is then used to derive the potential outside the sheath region surrounding a spherical probe immersed in an electro-negative plasma. It is found that the potential falls to low values when the ratio of negative ions to electrons exceeds 2. Under these circumstances the positive-ion current collected is the random current across the sheath edge. If, however, the ratio is much less than 2 then the collection of positive ions proceeds as for an electropositive gas. (auth)

21380

ELECTROSTATIC INTERACTIONS IN AN ELECTRON-ION GAS AT HIGH DENSITY. Toshiyuki Nishiyama (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 21, 389-408(1959) Mar.

Consideration is given to the influence of the Coulomb interaction of electrons upon the electron-ion interaction and the ionic oscillation of an electron-ion gas at high density by utilizing a method of normal modes on the one hand and a collective description on the other hand. Following these methods, the so-called Froelich Hamiltonian is derived for the electron-phonon interaction by eliminating the electronic plasmon from the total Hamiltonian completely. As the interactions between electron pairs with opposite momenta and with different spins which are essential to the superconductivity are discarded in the method of normal modes, the results obtained are considered as valid only for the normal state. These important interactions of electron pairs can be taken into account in the collective description, by means of which the electron-phonon Hamiltonian with the screened interaction of electrons is obtained. A dispersion equation for the system under consideration is obtained by the sound approximation proposed in a previous paper, which proves to be equivalent to Sawada's pair theory for small momentum transfers. The dispersion equation obtained exhibits a "metastable" state corresponding to the phonon excitation. The eigenfrequency and the decay time are estimated for a certain region of wave numbers. By the perturbation expansion of the density matrix in the sound approximation a relationship between the correlation energy and the dispersion equation is pointed out and the role of the Coulomb interaction of electrons is illustrated graphically. (auth)

21381

INTERACTIONS OF HYDROMAGNETIC WAVES. Yusuke Kato (Kobe Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 409-20(1959) Mar.

A generalized Rankine-Hugoniot relation for hydromagnetic shock waves propagating perpendicularly to

the magnetic field is discussed. Then the interaction of the shock or rarefaction waves with the contact surface on which the magnetic field has a discontinuity is analyzed by a graphical method. The motion of the high temperature part of a plasma surrounded by the strong magnetic field and the electric current is investigated applying the result of the above analysis. It is shown that under some initial condition the contracting motion of the plasma occurs succeeding its expansion. (auth)

21382

EQUATION OF STATE OF CLASSICAL ELECTRON GAS. Ryuzo Abe (Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 21, 475-6(1959) Mar.

An exact evaluation is presented of the free energy term which is expected to be the next higher order above the lowest one, the Debye-Hückel law. It is concluded that the Debye-Hückel is exact with respect to the λ order for purely Coulomb interactions as well as for the one with hard cores. (C.J.G.)

21383

ELECTRICITY GENERATION FROM MOVING GAS STREAMS. R. G. Voysey (Ministry of Power, London). Research (London) 12, 260-4(1959) July.

Various concepts of thermo-electric generators with no moving parts other than a gas stream are discussed. It would be possible to operate such devices at very high temperatures which could well correspond to high thermodynamic efficiencies. An electrodynamic generator rather like a Van de Graaff machine but using ionized particles has potential applications. (C.J.G.)

21384

LOW-IMPEDANCE SUPPLY FOR PHOTOMULTIPLIERS. Sheldon Penman (Columbia Univ., New York). Rev. Sci. Instr. 30, 745-6(1959) Aug.

A circuit modification for obtaining a low-impedance source for photomultiplier dynode voltages is described. (C.J.G.)

21385

CALCULATION OF THE MAGNETIC PROPERTIES OF THE HYDROGEN MOLECULE. H. F. Hameka (N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland). Z. Naturforsch. 14a, 599-602(1959) July. (In German)

For the calculation of the proton shielding and the magnetic susceptibility of the hydrogen molecule, wave functions formed from standard invariant atomic functions were derived. The calculations were carried out for two cases, where the wave functions of the ground state are described by the Wang or the Rosen approximation. The nuclear shielding constant and the susceptibility are 2.631×10^{-5} and -3.920×10^{-6} in the first case and 2.732×10^{-5} and -4.045×10^{-6} in the second case. (tr-auth)

21386

SEPARATION OF RADIOACTIVE XENON FROM HYDROGEN AND DEUTERIUM BY MEANS OF THERMODIFFUSION. D. Heymann (F.O.M.-Laboratorium voor Massaspectrografie, Amsterdam). Z. Naturforsch. 14a, 603-9(1959) July. (In German)

In suspension reactors the fission products escape from the fuel element into the moderator liquid or into the gas phase. Radioxenon and radiokrypton are removed, in principle, by absorption or radioactive decay; however, the thermodiffusion method offers some advantages. The thermodiffusion factor of Xe in H_2 and D_2 was measured in the temperature range from 300 to 700°K. Xenon-133 serves as a tracer for the determination of the concentration. The diffusion constant D_{Xe} and H_{Xe} were estimated with the help of the Chapman formula for hard spheres. A wrapped-wire tube was built whose optimum pressure is approximately atmospheric pressure. The separation factor, initial transport, and relaxation time of the tube was determined in dependence on the pressure and the mean gas temperature. The results show a satisfactory agreement with theory. At higher pressures it should be possible to purify approximately 3.7 liters of D_2 (S.T.P.) per hour and cm^2 of surface of a tube column (radius 5 cm and length 50 cm). In the "pure gas" the xenon concentration is about 10 times smaller than in the feed gas. (tr-auth)

21387

POTASSIUM–ARGON AGE OF SOME TEKTITES. W. Gentner and J. Zähringer (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 14a, 686-7(1959) July. (In German)

A new determination of the age of a Moldavite, Indochinite, Billitonite, and Australite was made using the potassium-argon method. One gram samples from each tektite was outgassed in ultra-high vacuum at 1600°C. The argon content and its isotopic composition was determined on a sensitive mass spectrometer. The values obtained are tabulated and show that the Moldavite is from the early Miocene, whereas the others are from the Pleistocene. The results are compared with those obtained by other investigators. (J.S.R.)

21388

THE VAPOR PRESSURE OF UF_4. M. M. Popov, F. A. Kostylev, and N. V. Zubova. Zhur. Neorg. Khim. 4, 1708-9(1959) Aug. (In Russian)

The vapor pressure of UF_4 (75.81% U and 24.19% F) was measured by passing it through a tubing device at 875 to 1000°C with argon, purified from oxygen and aqueous vapors, acting as transporting gas. (R.V.J.)

21389

END EFFECT ON PLASMA ROTATION IN A MAGNETIC FIELD. G. V. Gordeev (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 759-62(1959) June. (In Russian)

Studies were made of the column-end effects on the rotation of plasma in an axial external field and with radial current rotating around its axis. (R.V.J.)

21390

ON ILLUMINATION INDUCED CHANGES IN X-RAY INTENSITY REFLECTIONS FROM CdS MONOCRYSTAL. L. A. Smirnov and M. A. Rumsh (Leningrad State Univ.). Zhur. Tekh. Fiz. 29, 799(1959) June. (In Russian)

The effects of illumination on the x-ray intensity from a CdS monocrystal were studied by the ionization recording method. Measurements made with an order of accuracy of ±0.3% did not indicate any integral intensity changes. However, it was noticed that the illumination heats the crystal causing some displacement of the diffraction line. (R.V.J.)

21391

BASIC DATA OF PLASMA PHYSICS. Sanborn C. Brown. New York, John Wiley and Sons, Inc., 1959. 342p.

Lecture notes on a graduate course in gas discharges are presented. Topics covered include elastic-collision cross sections, diffusion and mobility, inelastic colli-

sions of electrons, diffusion and mobility, inelastic collisions of electrons, diffusion-controlled breakdown, electron attachment, and recombination. (C.J.G.)

21392

SYMPOSIUM ON BASIC MECHANISMS OF FATIGUE. Presented at the Sixty-first Annual Meeting, American Society for Testing Materials, Boston, Mass., June 23, 1958. ASTM Special Technical Publication No. 237. Philadelphia, American Society for Testing Materials, 1959. 124p. $3.75.

Discussions of dislocation behavior in LiF crystals during cyclic loading, fatigue crack formation in AgCl, internal friction, plastic strain, and fatigue in metals and semiconductors, slipband formation and fatigue cracks under alternating stress, cycle-dependent stress relaxation, and recent observations on fatigue failure in metals are included. (J.E.D.)

21393

IMPROVEMENTS IN SHIELDS FOR PROTECTION AGAINST NEUTRONS. (to Commissariat à l'Énergie Atomique). British Patent 816,235. July 8, 1959.

A flexible neutron shielding material and its preparation are described. Polyvinyl chloride is heated to a pasty condition and boron carbide or other neutron-absorbing powder is added and the mixture is molded into the desired shape. Also the PVC resin may be dissolved, mixed with absorber, and molded and heated. (T.R.H.)

21394

PORTABLE THULIUM X-RAY UNIT WITH SEPARABLE UNIVERSAL MOUNTING MEANS. Eugene W. Coleman and Lawrence H. Krohn (to U. S. Army). U. S. Patent 2,891,167. June 16, 1959.

A portable radiography device is described. The thulium source is contained in a shielded vessel with a shutter operating means. The source is mounted on tripod legs and is placed over the object to be radiographed. (T.R.H.)

21395

PORTABLE SOURCE OF RADIOACTIVITY. Raymond C. Goertz, Kenneth R. Ferguson, Elmer William Rylander, Lenard M. Safranski (to U. S. Atomic Energy Commission). U. S. Patent 2,891,168. June 16, 1959.

A portable source for radiography or radiotherapy is described. It consists of a Tl^{170} or Co^{60} source mounted in a rotatable tungsten alloy plug. The plug rotates within a brass body to positions of safety or exposure. Provision is made for reloading and carrying the device safely. (T.R.H.)

Elementary Particles

21396 AFOSR-TN-59-486

Yale Univ., New Haven.

COMPENSATIONS IN ELECTRON EXCITATION EFFECTS IN p-p AND p-n SCATTERING. M. de Wit, C. R. Fischer, and W. Zickendraht. May 5, 1959. 13p. Contract AF18(600)-771. (AD-215779).

An account is given of calculations for monopole, dipole, and quadrupole Coulomb excitation in p-n and p-p scattering. These were carried out according to the same general plan as that used by Breit, Phys. Rev. Letters 1, 200(1958). For each of the three multipoles the effects of the different channels were combined and finally the incoherent contributions were added to the effects of the cross product terms on the coherent scattering. (W.D.M.)

21397 CNC-14

Italy. Comitato Nazionale per le Richerche Nucleari, Milan.

IL RALLENTAMENTO DEI NEUTRONI IN UN MEZZO OMOGENEO INFINITO. I. RALLENTAMENTO SENZA CATTURA. (The Slowing Down of Neutrons in an Infinite Homogeneous Medium. I. Slowing Down Without Capture.) V. Boffi. Aug. 1959. 35p.

The slowing down of neutrons in an infinite homogeneous medium is studied. The investigation is based on the discussion of the integral equations obeyed by a characteristic differential quantity which is the average number of collisions a neutron undergoes in an infinitesimal interval of lethargy. The slowing down process without capture is considered in this first part. (auth)

21398 LMSD-48395

Lockheed Aircraft Corp. Missile Systems Div., Sunnyvale, Calif.

SHIELDING AGAINST FAST PROTONS IN THE TRAPPED RADIATION BELT. Jan. 15, 1959. 23p. (AD-211505).

Satellite experiments on the radiation belt surrounding the earth have indicated an intense high-energy flux of particles. Present theory holds this radiation to be fast protons. The energy loss and range of such protons in matter is important for the determination of biological and non-biological radiation damage and the shielding required to reduce this damage to tolerance levels. An investigation of proton stopping and straggling in matter was undertaken and some preliminary results are given. (W.D.M.)

21399 UCRL-Trans-485

EXCHANGE COLLISIONS OF FAST NUCLEONS WITH DEUTERONS. [PART] I. I. Ia. Pomeranchuk. Translated from Zhur. Eksptl'. i Teoret. Fiz. 21, 1113-22 (1951). 13p. $3.30(ph), $2.40(mf) JCL or LC.

Effective cross sections of exchange collision of fast nucleons with deuterons are studied. Data on collisions of free nucleons are used. It is shown that the influence of particle bond in deuterons and the application of the Pauli Principle make it possible to establish experimentally the spin dependence of exchange forces in comparing cross sections of exchange collision of nucleons with deuterons and with free nucleons. (auth)

21400 UCRL-trans-486

POLARIZATION OF RECOIL PROTONS IN ELASTIC π^+-p-SCATTERING AT THE ENERGY OF 307 Mev. Ye. (E.) L. Grigor'ev and N. A. Mitin. Translated from a publication of the Joint Institute for Nuclear Research, Dubna, 1959. 19p. $3.30(ph), $2.40(mf) JCL or LC.

An experiment on recoil proton polarization in π^+-p scattering at 307 Mev and an angle of $140 \pm 8°$ in the center-of-inertia system is described. On the basis of the data on the value of left-right asymmetry, polarization equal to $P_1 = -0.19 \pm 0.17$ was determined. Phase-shift analysis of the differential cross sections is discussed. (W.D.M.)

21401

CHECK OF THE DISPERSION RELATIONS FOR THE PHOTOPRODUCTION OF π-MESONS. A. M. Baldin and B. B. Govorkov. Doklady Akad. Nauk S.S.S.R. 127, 993-6(1959) Aug. 11. (In Russian)

A report is presented on a certain disagreement found in experimental data on photoproduction of π^0 mesons, $\gamma + p \rightarrow p + \pi^0$, and certain conclusions are derived on the basis of dispersion relations. The cause of the disagreement obviously should be found in the assumption that the single photoproduction amplitude rapidly approaches zero as $W \rightarrow \infty$. (R.V.J.)

21402

DECAY OF Ir^{192}. Jozsef Mraz. Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 338-43(1957). (Translated from Referat. Zhur. Fiz. No. 2, 1959, Abstract No. 2799.)

By measuring the angular correlation of γ rays with energies 308-296, 308-316, and 296-316 kev, the spin of the fourth excited level of Pt^{192} was determined. The spin was found to be J = 4. A theoretical interpretation of the excited levels of Pt^{192} was found. (auth)

21403

SIGMA SPIN AND PARITY CONSERVATION IN $K^- + p \rightarrow \Sigma^+ + \pi^-$. Jack Leitner, Paul Nordin, Jr., Arthur H. Rosenfeld, Frank T. Somitz, and Robert D. Tripp (Univ. of California, Berkeley). Phys. Rev. Letters 3, 238-9 (1959) Sept. 1.

In $K^- + p \rightarrow \Sigma^+ + \pi^-$ reactions s-state capture leads to Σ-decay angular distributions that are unique functions of the Σ spin. On the basis of an analysis of 82 $\Sigma^+ \rightarrow \pi^0 + p$ and 63 $\Sigma^+ \rightarrow \pi^+ + n$ events, very strong evidence for a spin $-\frac{1}{2}$ sigma was found. A check on the hypothesis of parity conservation in the reaction $K^- + p \rightarrow \Sigma^+ + \pi^-$ was made. (W.D.M.)

21404

PHOTOPRODUCTION OF NEUTRAL MESONS FROM HYDROGEN NEAR THRESHOLD. P. D. Luckey, L. S. Osborne, and J. J. Russell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Letters 3, 240-2(1959) Sept. 1.

The differential cross section for the $\gamma + p \rightarrow p + \pi^0$ reaction was obtained for mean gamma energies of 170 and 190 Mev by measuring single π^0-decay γ-ray yields from a liquid hydrogen target at laboratory angles 48, 81, and 141°, and bremsstrahlung peak energies 160, 180, and 200 Mev. The decay gamma rays were detected by a total absorption spectrometer. (W.D.M.)

21405

POSSIBILITY OF STUDYING THE Λ-HYPERON–NUCLEON FORCE BY LOW-ENERGY SCATTERING. C. G. Gardner and T. A. Welton (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 3, 281-3(1959) Sept. 15.

Current ideas concerning the lambda-nuclear force derive primarily from (a) meson-theoretic static models, together with restrictions imposed by isotopic spin conservation, and (b) analysis of the binding energies and decay made branching ratios of hyperfragments Characterization of the Λ-N force following from these considerations is listed. The polarization which arises in the production of Λ-hyperons is discussed and it is pointed out that it may be used in a simple way to explore the spin dependence of the s-state Λ-N force. (W.D.M.)

21406

POSSIBLE EVIDENCE FOR A NEGATIVE HEAVY MESON. T. Yamanouchi and M. F. Kaplon (Univ. of Rochester, N. Y.). Phys. Rev. Letters 3, 283-4(1959) Sept. 15.

Following the report of the High-Energy conference at Kiev in which evidence was presented for the existence of a heavy positive meson decaying into a π^+ and a K^0, an emulsion stack exposed to the 300-Mev/c Berkeley K^- beam was rescanned for stars which might indicate anomalously high-energy release. Two events of interest were found, one of which gives possible evidence of a new negative meson. (W.D.M.)

21407

p–p CROSS SECTIONS FROM 534 TO 1068 Mev. T. Elioff, L. Agnew, O. Chamberlain, H. Steiner, C. Wiegand, and T. Ypsilantis (Univ. of California, Berkeley). Phys. Rev. Letters 3, 285-8(1959) Sept. 15.

Measurements of the p–p, elastic, inelastic, and charge-exchange cross sections are reported for antiproton energies of 534, 700, 816, 948, and 1068 Mev. The total cross section remains large with respect to N-N cross sections in the same energy range. A schematic diagram of the experimental setup is given. The 6-Bev internal proton beam of the Bevatron impinged on a carbon or polyethylene target at one of three different target positions. (W.D.M.)

21408

SEARCH FOR THE REACTION $\mu^+ + e^- \rightarrow \gamma + \gamma$. C. M. York, C. O. Kim, and W. Kernan (Univ. of Chicago). Phys. Rev. Letters 3, 288-91(1959) Sept. 15.

One of few reactions in which the direct interaction of two light fermions can be studied is the annihilation process $\mu^+ + e^- \rightarrow \gamma + \gamma$. This reaction can be compared directly with the more familar positron annihilation process. A beam of π^+ mesons was brought to rest in a $\frac{1}{4}$-in.-thick disk of copper. A schematic diagram of the experimental setup and a block diagram of the electronic circuits are given. (W.D.M.)

21409

OBSERVATION OF He^4 HYPERFRAGMENTS FROM K^--He INTERACTIONS: THE K^--Λ RELATIVE PARITY. M. M. Block, E. B. Brucker, I. S. Hughes, T. Kikuchi, and C. Meltzer (Duke Univ., Durham, N. C.); F. Anderson and A. Pevsner (Johns Hopkins Univ., Baltimore); E. M. Harth and J. Leitner (Syracuse Univ., N. Y.); and H. O. Cohn (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 3, 291-2(1959) Sept. 15.

The Duke University helium bubble chamber was exposed to a separated low-energy K^- beam. Approximately 2500 K^- interactions at rest were obtained. In a partial scan, evidence was found for the production of He^4 hyperfragments in the reaction $K^- + He^4 \rightarrow {}_\Lambda He^4 + \pi^-$. The relative K^--Λ parity can be inferred from the reaction if it is assumed that parity is conserved, the spins of K^- and ${}_\Lambda He^4$ are zero, and no bound excited states of ${}_\Lambda He^4$ exist. The K^--Λ relative parity was established to be negative. (W.D.M.)

21410

LEPTONIC DECAY MODES OF THE K MESON. K. Chadan and S. Oneda (Univ. of Maryland, College Park). Phys. Rev. Letters 3, 292-5(1959) Sept. 15.

How far the so-called V-A Fermi interaction can account for the strangeness-nonconserving weak interactions is investigated. It has been noticed that the observed rates of the decays, $K^0 \rightarrow \pi^+ + e^- + \nu$ and $K^+ \rightarrow \pi^0 + e^+ + \nu$, seem to be anomalously small compared with the universal rates. Using a dispersion technique, it is conjectured that the rate of $K + \mu + \nu$ decay is not in contradiction with the experimentally indicated slow rates of hyperon decays into leptons. (W.D.M.)

21411

K^+-K^0 MASS DIFFERENCE. P. T. Matthews and J. L. Uretsky (Imperial Coll., London). Phys. Rev. Letters 3, 297-9(1959) Sept. 15.

It has recently been established that the K^0, like the neutron, is a concentration of positive and negative charge, giving total charge zero, but with a non-vanishing charge density. It is quite simple to construct physically reasonable charge distributions for K^0 and K^+ such that the neutral particle has the greater electrostatic energy. Such a model is constructed and it is shown that this classical interpretation of the self-energy is very closely related to the leading term in the field-theoretic calculation. (W.D.M.)

21412

ELECTRON MODEL DEVICE FOR DEVELOPING DATA ON WIDE ATMOSPHERIC COSMIC RAY SHOWERS. G. V. Bogoslovskii and B. A. Khrenov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 4, 37-40(1959) July-Aug. (In Russian)

Descriptions are given of an electron-model device used for determining the most probable position of the axis of a wide atmospheric shower and the number of particles in the shower. The device yields a mathematically precise solution for the problem and suggests the probable distribution along the coordinates of the shower axis in the plane of observation. A mathematical analysis is made of the order of accuracy. (tr-auth)

21413

GRAVITATIONAL WAVES IN GENERAL RELATIVITY. IV. THE GRAVITATIONAL FIELD OF A FAST-MOVING PARTICLE. F. A. E. Pirani (Martin Co., Baltimore). Proc. Roy. Soc. (London) A252, 96-101(1959) Aug. 25.

It is shown, in an invariant manner, that the gravitational field of a fast-moving mass bears an increasing resemblance to a gravitational plane-wave field, the greater the speed of the mass. (auth)

21414

GLOBAL SYMMETRY AND ISOTOPIC SPIN CONSERVATION IN NON-LEPTONIC HYPERON DECAYS. Gyo Takeda and Masaaki Kato (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto) 21, 441-51(1959) Mar.

Possible existence of the universal $V \mp A$ coupling and the global symmetry in the non-leptonic hyperon decays is discussed. The observed deviations from the expected symmetries in actual decays are explained as effects due to the mesonic structure of hyperons. In a close relation with the idea of the global symmetry a new isotopic spin is defined, which is $\frac{1}{2}$ for all the baryons and an integer for K. The conservation law of this isotopic spin is satisfied in the non-leptonic decays. (auth)

21415

DETERMINATION OF THE PION-NUCLEON COUPLING CONSTANT BY MEANS OF THE NUCLEON-NUCLEON DISPERSION RELATION. Sadahiko Matsuyama (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto) 21, 452-8(1959) Mar.

Making use of the dispersion relation for nucleon-nucleon scattering, the coupling constant between pion and nucleon is determined from the neutron-proton scattering length in triplet state and the binding energy of the deuteron. The coupling constant $g^2/4\pi$ thus determined coincides with those deduced by other theories. (auth)

21416

A NOTE ON POLARIZED CROSS SECTION OF HIGH ENERGY n–d ELASTIC SCATTERING. Yoshiyuki Sakamoto (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 459-60(1959) Mar.

Results are presented for the calculation of polarized cross sections for n–d elastic scattering using two sets of phase shifts of nucleon–nucleon scattering. (C.J.G.)

21417

NEW EQUATION OF SPIN 1/2 PARTICLES AND ISOMORPHISM BETWEEN VARIOUS TRANSFORMATIONS. Zensuke Tokuoka (Wakayama Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 471-3(1959) Mar.

The general formulation of the wave matrix theory is reconstructed by re-interpretation of the direct-product representations of γ matrices. Gürsey's wave matrix is also derived by application of the above formalism to the wave function ϕ. (C.J.G.)

21418

ORIGIN OF COSMIC RAYS REVEALED IN THE RIGIDITY SPECTRUM OF PRIMARY PARTICLES. Satio Hayakawa (Kyoto Univ.) and Masatoshi Koshiba (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 473-5(1959) Mar.

A discussion is presented on the mechanisms effective in producing the cosmic radiation revealed in the rigidity spectrum of primary particles. (C.J.G.)

21419

FIELD THEORETICAL INTERPRETATION OF MULTIPLE MESON PRODUCTION. Tsutomu Imamura (Univ. of North Carolina, Chapel Hill) and Keizo Kobayakawa (Nara Medical College, Japan). Progr. Theoret. Phys. (Kyoto) 21, 477-8(1959) Mar.

The formula for the cross section of multiple production of mesons is derived under the following assumptions: the interaction between a nucleon and a meson(π) is present only for a finite time interval 0 to t with the free Hamiltonian H_0 regarded as a C-number; the concept of renormalization is assumed to get only the relative cross section of n meson(π) production. (C.J.G.)

21420

POLARIZATION EFFECTS UNDER DECELERATION RADIATION AND PAIR FORMATION. I. M. Nadzhafov. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. Khim. No. 5, 209-12(1958).

Polarization effects in bremsstrahlung and pair formation is considered in the general case with arbitrary angular and energy distribution. (J.S.R.)

21421

SKHEMY RASPADA RADIOAKTIVNYKH YADER. (Decay Schemes of Radioactive Nuclei.) Boris Sergeyevich Dzhelepov and Leon Kaufmanovich Peker. Moscow, Izd-vo AN SSSR, 1958. 780p.

All information available on decay schemes to the end of 1957 is presented. The 256 decay schemes include those of many odd-odd isotopes in the domain of deformed nuclei with A = 150 to 190 and A > 222 which were rechecked and constructed or essentially changed to correspond with modern conceptions of the unified shell model about the nature of rotational and vibrational levels. If a nucleus has several low levels which are excited only by nuclear reactions but not by processes of radioactive decay, only those levels of this type which are energetically accessible for alpha-beta-

decay are shown. Alongside alpha- and beta-transitions, data such as energy in kev, the intensity of transition, and the log value of τf are given. All schemes are accompanied by a supplement including experimental data concerning the decay of radioactive nuclei, obtained in the years 1953 to 1957. Data are included on the values of spins, magnetic dipole, and electric quadrupole moments of stable nuclei obtained in the same period. (auth)

21422

VARIATSII INTENSIVNOSTI KOSMICHESKIKH LUCHEY. (Variations of the Intensity of Cosmic Ray.) Yu. G. Shafer, ed., Moscow, Izd-vo AN SSSR, 1958. 168p.

Articles are presented on experimental methods in the continuous registration of cosmic rays, the investigation of meteorological effects of the different components of cosmic rays, and the connection between variations in cosmic ray intensity and solar and magnetic activity. Apparatuses used in measuring cosmic-ray intensity on and under the earth's surface and in the upper layers of the atmosphere are described. A discussion of the ASK automatic ionization chamber is included. The theory, methods, and results of the investigation of meteorological effects of cosmic ray components are also discussed as well as the characteristics of daily variations in cosmic ray activity. (auth)

Heat Transfer and Fluid Flow

21423 AAEC/E.8

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

THE USE OF A RADIOACTIVE TRACER (IODINE 131) IN THE INVESTIGATION OF A POWER STATION COOLING POND AT MAITLAND N.S.W. W. R. Ellis, R. A. Fookes, Marion E. Gardner, J. N. Gregory, J. B. Kirkwood, A. N. Lamb, and J. S. Watt. Sept. 1958. 43p.

Iodine-131 as iodide in solution was used to trace the flow of power station condenser water through a cooling pond. The station has a rating of 20Mw and the circulating water is cooled in a pond of approximately 2×10^8 gallons capacity and 40 acres area. By labeling the warm water with 473 millicuries of I^{131} in potassium iodide carrier, introduced at the power station outlet, and using underwater scintillation and Geiger counters, it was possible to follow quantitatively the horizontal and vertical spread of the water over a period of eight days after which mixing was complete. The results gave valuable information on the pond performance under the weather conditions prevailing during the test period and indicated some possibilities for improvement of performance. (auth)

21424 BMI-918

Battelle Memorial Inst., Columbus, Ohio.

A RECIRCULATING SUPERCRITICAL WATER LOOP. H. M. Epstein, W. H. Goldthwaite, J. W. Chastain, and S. L. Fawcett. Oct. 25, 1954. Decl. Aug. 10, 1959. 20p. Contract W-7405-eng-92. $3.30(ph), $2.40(mf) OTS.

A recirculating high-pressure stainless steel loop was developed for the study of heat transfer from small-bore tubes to supercritical water. It was found that under certain conditions, hot spots developed on the test section. The conditions leading to the formation of hot spots were investigated. The results of several runs are tabulated. In developing the loop, several components were developed. These include a Dowtherm condensor, a steam accumulator, and a bellows-type pump. (auth)

21425 CF-54-1-155

Oak Ridge National Lab., Tenn.

INTERMEDIATE HEAT EXCHANGER TEST RESULTS. B. M. Wilner and H. J. Stumpf. Jan. 29, 1954. Decl. July 16, 1959. 35p. Contract [W-7405-eng-26]. $6.30 (ph), $3.00(mf) OTS.

A six-tube-bundle Inconel model of a fluoride to sodium heat exchanger, after successfully operating for 1680 hr at an average temperature of 1300°F, was accidentally frozen as a consequence of a power failure. When the unit was reheated, the pump shaft could not be turned so the unit was opened and visually inspected. The molten fluoride gas-sealed sump type pump had been operated without trouble for 1370 hr. The graphite gas seal performed with negligible helium leakage and proved to be satisfactory. Upon removal of the pump from the system, it was found that fluoride vapor had condensed on the cold roof of the sump. The deposits had caused binding of the pump shaft when the system was accidentally shut down and allowed to freeze. There was very little indication of corrosion and the fluoride as drained from the system was colorless. No leaks appeared to be present in the system. With the equipment available, it was only possible to operate the fluoride system in the laminar flow region. The experimental data for the fluoride mixture indicated that the heat transfer coefficient in the laminar flow region was 50 to 60% of the value predicted by theory. This might have been due to the formation of an insoluble fluoride film with high thermal resistance. The only other possibilities which might account for the discrepancy are experimental error or inadequacy of the theory in describing the heat transfer in this flow regime. (J.E.D.)

21426 CF-55-12-120

Oak Ridge National Lab., Tenn.

THERMAL CHARACTERISTICS OF THE ART FUEL-TO-NaK HEAT EXCHANGER. J. L. Wantland. Dec. 22, 1955. Decl. Sept. 15, 1959. 32p. $6.30(ph), $3.00(mf) OTS.

A heat exchanger using a tube bundle similar to that which is presently planned to be used in the ART fuel-to-NaK heat exchanger was fabricated and instrumented for the determination of the heat transfer and fluid friction characteristics of the fuel side of this heat exchanger. Heat transfer data were obtained by using the apparatus as a water-to-water heat exchanger and by resistance heating the tube bundle. In the range N_{Re}= 1,500 to 10,000, the heat transfer and isothermal friction characteristics may be expressed by $N_{Nu}/N_{Pr}^{0.4} = 0.0155\ N_{Re}^{0.8}$ and $f = 1.75/N_{Re}^{0.28}$ where $f = \Delta p/(L/D_w)(Pu^2/2g_c)$. The results of this investigation are compared with the results from similar configurations by other investigators. (auth)

21427 CF-56-6-143

Oak Ridge National Lab.

TRANSVERSE PRESSURE DIFFERENCE ACROSS STAGGERED AND INCLINED SPACERS IN THE ART FUEL-TO-NaK HEAT EXCHANGER. J. L. Wantland. June 29, 1956. Decl. Sept. 15, 1959. 11p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The ART fuel-to-NaK heat exchanger was modified with six 60° staggered spacers and six 60° inclined spacers alternately placed. Transverse pressure taps

were installed across one spacer of each type. The average transverse pressure difference across each instrumented spacer was expressed in terms of the ratio of the transverse pressure difference to the quantity, $\rho u^2/2g_c$, over the Reynolds modulus range of 3,000 to 8,000. For the inclined spacer, this term fell between 1.4 and 1.1; for the staggered spacer, the data varied randomly between 0.01 and 0.3 with no definite trend established. The tube bundle friction factor was also determined and fell about 10% below the data previously obtained using vertical spacers. (auth)

21428 CF-56-10-39
Oak Ridge National Lab., Tenn.
EFFECT OF SPACER DENSITY ON HEAT TRANSFER AND PRESSURE DROP IN THE ART FUEL-TO-NaK HEAT EXCHANGER. J. K. Wantland. Oct. 10, 1956. Decl. Sept. 15, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

Heat transfer and isothermal friction characteristics of the experimental ART fuel-to-NaK heat exchanger have been determined for three degrees of spacer density. The data appear to indicate that for a given heat exchanger pressure drop, the heat transfer coefficient is almost independent of the spacer density; as the spacer density is decreased, the Reynolds modulus increases to such an extent that the Nusselt modulus does not change significantly. For a given available pressure drop, with decreased spacer density, a larger flow rate exists allowing the same heat removal rate with a lower axial temperature change or a greater heat removal rate with the same axial temperature change. (auth)

21429 CF-59-6-9
Oak Ridge National Lab., Tenn.
HEAT TRANSFER IN SEPTAFOIL GEOMETRIES BY MASS-TRANSFER MEASUREMENTS. J. L. Wantland and R. L. Miller. June 30, 1959. 29p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

In conjunction with Gas-Cooled Reactor heat-transfer studies, local and mean heat-transfer factors are predicted from the heat transfer-mass transfer analogy using subliming naphthalene in air. Experimentation was conducted on 1-in.-diam septafoil rods in a 4-in.-diam flow channel with rod center-to-center spacings of 1.10, 1.25, and 1.40 in. at a Reynolds modulus of approximately 60,000. Ratios of local mass transfer to mean mass transfer for a given rod vary as much as from 0.7 to 1.3 (outer rod, 1.10-in. spacing). Mean values of the mass-transfer factor are, in general, above that predicted by the correlation $j = 0.023\ N_{Re}^{-0.2}$; as much as 48% for the outer rod at 1.25-in. spacing. Experimentation conducted on an outer rod at 1.40-in. spacing with a swirl generator at the inlet to the cluster indicate an increase in mass transfer over that with straight flow through the same configuration (with a corresponding increase in pressure drop) but no appreciable decrease in mass-transfer variation around the periphery of the rod. (auth)

21430 CF-59-8-57
Oak Ridge National Lab., Tenn.
DETERMINATION OF SUITABLE INSULATION FOR A 1-5/16" HELIUM FILLED ANNULUS IN THE ORR HELIUM IN-PILE LOOP, DESIGN NO. 4. R. B. Knight and R. E. Helms. Aug. 17, 1959. 61p. Contract [W-7405-eng-26]. $12.30(ph), $4.50(mf) OTS.

Heat loss tests were conducted with six insulation configurations for application in the riser regenerator and auxiliary regenerator sections of the loop. Insulation consisting of ten laminations of 0.003 in. stainless steel shim stock spaced $\frac{1}{8}$ inch apart produced a temperature drop across the $1\frac{5}{16}$ inch annulus of 1200°F with a heat loss of 1.04 KW per foot of 2 inch schedule 40 pipe. The curve of heat loss vs. temperature difference is presented which, with results of similar tests with a $\frac{1}{4}$ inch annulus, will permit the evaluation of a heat balance and temperature profile for the entire loop. (auth)

21431 NAA-SR-3882
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ELECTRICAL HEATING METHODS FOR LIQUID-METAL SYSTEMS. R. S. Baker and H. W. Lohman. Sept. 15, 1959. 16p. Contract AT-11-1-GEN-8. $0.50 (OTS).

The application of electric heating to liquid-metal piping systems is discussed. Three electrical methods—resistance, induction, and transformer heating—are identified and described. Temperature variation along an induction heated pipe is explained as a magnetic phenomenon. A comparison of the three heating methods is offered. (auth)

21432 ORNL-2677
Oak Ridge National Lab., Tenn.
ALUMINUM CHLORIDE AS A THERMODYNAMIC WORKING FLUID AND HEAT TRANSFER MEDIUM. M. Blander, L. G. Epel, A. P. Fraas, and R. F. Newton. Oct. 5, 1959. 29p. Contract W-7405-eng-26. $1.00 (OTS).

The basic physical properties and thermodynamic constants of aluminum chloride have been calculated to obtain the data required for engineering calculations of thermodynamic cycles employing aluminum chloride vapor. The possible corrosion problems involved were evaluated from the standpoint of basic chemical thermodynamics, and it was concluded that high-nickel-content alloys would contain aluminum chloride satisfactorily. The advantages of gaseous aluminum chloride as an intermediate heat transfer medium in a molten-salt-fueled reactor was evaluated. It was determined that the temperature range of the molten-salt heat transfer system was too low to utilize aluminum chloride effectively. A gas-turbine cycle employing aluminum chloride as the working fluid and a binary vapor cycle employing water vapor for the lower temperature cycle were also considered. Neither of these studies showed aluminum chloride to have outstanding advantages. It is believed, however, that special applications may be found in which it will be possible to exploit the unique characteristics of aluminum chloride. (auth)

21433 SCTM-202-59(51)
Sandia Corp., Albuquerque, N. Mex.
AN ERROR ANALYSIS OF AN APPROXIMATION TO THE TEMPERATURE DISTRIBUTION IN AN INFINITE CYLINDER WITH RADIATION AT THE SURFACE. S. Bell. July 29, 1959. 14p. $3.30(ph), $2.40(mf) OTS.

The derivation is presented of an approximate formula for the one-dimensional temperature distribution in a circular cylinder when the initial temperature is constant and radiation occurs at the surface of the cylinder. The result is appropriate for large values of the product (measured in cylinder radii) of the surface thermal resistance and the material thermal conductivity. Error bounds are determined, and a few sample graphs are included. (auth)

21434 AEC-tr-3770

HEAT TRANSFER IN CONDENSATION AND BOILING. Second Edition, Revised and Enlarged. (Teploperedacha pri Kondensatsii i Kipenii.) S. S. Kutateladze. Translated by S. J. Rimshaw from a publication of the State Scientific and Technical Publishers of Literature on Machinery, Moscow–Leningrad, 1952. 215p. $2.25 (OTS).

Basic principles of heat exchange during a change in state and data dealing with heat transfer in condensation and boiling are presented. Various kinds of boiling are examined along with certain aspects of vapor-liquid system hydrodynamics. Thermodynamics is emphasized, and included information may be of use to heat exchanger designers as well as engineering students. (J.R.D.)

21435

THERMODYNAMIC AND TRANSPORT PROPERTIES OF GASES, LIQUIDS AND SOLIDS. Papers Presented at the Symposium on Thermal Properties, February 23-26, 1959, Purdue University, Lafayette, Indiana. New York, American Society of Mechanical Engineers, 1959. 481p.

Twenty-six papers have been picked up from the symposium covering the subjects: theoretical estimation of transport properties, recent work on transport properties, thermodynamic properties of gases and liquids, PVT data and equation of state, thermodynamic properties of B compounds, transport properties, and high temperature transport properties of metals, gases, and ceramics. Separate abstracts have been prepared from each paper. (W.L.H.)

21436

THEORIES OF GAS TRANSPORT PHENOMENA. J. S. Dahler (Wright-Patterson Air Force Base, Ohio). p.14-24 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Some of the more recent developments in the kinetic theory of gases are summarized. The paper begins with brief remarks about the Boltzmann equation and points out that because of its fundamental role in the kinetic theory this equation and its several modifications have been and will continue to be popular subjects for theoretical research. In the subsequent sections the Chapman-Enskog theory of gas transport properties is outlined and a description is given of several applications and extensions of this technique to high temperature phenomena, reacting mixtures and gases composed of polyatomic molecules. (auth)

21437

REVIEW OF MODERN THEORY OF THE THERMAL CONDUCTIVITY OF METALS. D. J. Schleef (Purdue Univ., Lafayette, Ind.). p.25-37 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Conduction of heat in metals occurs through the behavior of the electrons and the crystal lattice under the influence of a temperature gradient. In pure metals, the electronic conductivity is dominant, because of the mobility of free electrons, and the absence of impurities to scatter them. The theory of conduction of heat in an electron gas has been developed on the basis of a relatively simplified model, considering quasi-free electrons in a periodic potential field due to the lattice, and introducing the scattering effect resulting from thermal excitation of the lattice. The results of the theory and its subsequent refinements are in good agreement with experimental data, particularly for the monovalent metals. The theory of thermal conduction in a crystal lattice, treated as a phonon gas, shows that thermal resistance is largely governed by phonon interaction (anharmonicity of lattice vibrations), particularly at higher temperatures. The theory is well borne out by experimental data on dielectric crystals. By postulating a characteristic temperature dependence for each of the component thermal resistances corresponding to individual scattering effects, using the elements of the theory for each scattering mechanism, the total resistance curve may be composed in a semiempirical manner, in order to provide a rational basis for the experimental results. (auth)

21438

SURVEY OF RECENT WORK ON THE VISCOSITY, THERMAL CONDUCTIVITY AND DIFFUSION OF GASES AND GAS MIXTURES. P. E. Liley (Purdue Univ., Lafayette, Ind.). p.40-69 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Recent theoretical and experimental studies of transport properties of gases and gas mixtures are reviewed. Emphasis is given to data reported for high temperatures while no data for temperatures below the ice point are reviewed. Summary tables are given to enable easy access to references for the pressure and/or temperature dependence for a particular property and gas. Suggestions are appended for work urgently required and a bibliographic listing of 550 references given. (auth)

21439

REVIEW OF AVAILABLE EXPERIMENTAL DATA ON THE VISCOSITY OF STEAM. J. Kestin and J. R. Moszynski (Brown Univ., Providence). p.70-7 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

A critical review of existing experimental data on the viscosity of steam and compressed water is presented. At low pressures, i.e., up to about 1 atm, the existing data correlate with an estimated accuracy of ±1.5% with the aid of the equations

$$\mu = \frac{25.64\sqrt{T}}{1 + \frac{1371}{T} \times 10^{-37.4/T}} \times 10^{-6} \text{ poise for } T < 1100 \text{ C}$$

and

$$\mu = \frac{14.98\sqrt{T}}{1 + \frac{24.51 \times 10^4}{T^2}} \times 10^{-6} \text{ poise for } T \times 1100 \text{ C}.$$

It is hoped that the second of these equations may offer a reasonable means for extrapolating to, say, 2000°C. At higher pressures no reasonable agreement can be found between the various data now available. Even the most comprehensive set of values due to D. L. Timrot is open to doubt at temperatures in excess of 450°C because the excess viscosity $\mu_e - \mu_0$ does not correlate into a single function of density, as it does for many other substances. (auth)

21440

TRANSPORT PROPERTIES OF MULTICOMPONENT GAS MIXTURES AT HIGH TEMPERATURES. C. W. Baulknight (General Electric Co., Philadelphia). p.92-9 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Transport and thermodynamic properties of gaseous

systems enter into engineering calculations whenever there is a concern for heat transfer. The transference of mass, momentum, and energy of the system under investigation dictates design parameters and in many instances the type of material which should be used. Giving due consideration to practical applications but without seriously affecting the validity of the results, certain transport and thermodynamic properties have been computed for a multicomponent gaseous system consisting of CO_2, CO, H_2O, HCl, and N_2. These properties have been computed in the temperature range from ambient to 10,000°K. Curves and tabulated values of the data are presented. (auth)

21441

THE UNMIXING OF METAL SOLUTIONS BY A TEMPERATURE GRADIENT. R. A. Oriani (General Electric Co., Schenectady, N. Y.). p.123-9 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The effect of a temperature gradient upon an initially homogeneous mixture of gases has been known and moderately well understood for some time. It is only recently, however, that the analogous effect has been observed in condensed metallic systems. The presently known information on the unmixing caused by a temperature gradient (The Soret effect) is reviewed. The phenomenon is discussed in the context of the thermodynamics of irreversible phenomena and from the point of view of some naive models. The importance of the Soret effect to the theory of diffusion and to technology is discussed. It is shown that the theory of localized vibrational modes provides a physical reason for expecting positive or negative heats of transport for the case of interstitial solutes. (auth)

21442

THERMODYNAMIC AND ELECTRICAL PROPERTIES OF NITROGEN AT HIGH TEMPERATURES. F. Martinek (General Electric Co., Cincinnati). p.130-56 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The basic thermodynamic properties of pure nitrogen at high temperatures are presented. Internal energy, enthalpy, entropy, electron density and electrical conductivity are given in engineering units for the temperature range from 5000 to 30,000°K, and pressures varying from 0.2 to 100 atm. The temperature and pressure dependency of dissociation and ionization is also shown. All calculations are based on statistical thermodynamics. (auth)

21443

THE VIRIAL EQUATION APPLIED TO STEAM. P. E. Liley (Purdue Univ., Lafayette, Ind.). p.211-19 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Virial coefficients and derivatives have been calculated from the Keenan and Keyes Steam Tables and are reproduced in tabular form for temperatures from 200 to 1200°F. Data resulting from the application of the virial expansion are reproduced and compared with the original data. The method of calculation is explained and further work is suggested. (auth)

21444

CHARACTERIZATION OF UNUSUAL GASEOUS OXIDE AND HYDROXIDE MOLECULES IN M–O–H SYSTEMS AT HIGH TEMPERATURES. F. T. Greene, S. P. Randall, and J. L. Margrave (Univ. of Wisconsin, Madison). p.222-5 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The importance of gaseous oxides and hydroxides of complex structures in high temperature systems has been shown by indirect and direct chemical and physical measurements. Mass spectroscopy, visible, infrared, and microwave spectroscopy have been applied to yield structural data and to form the basis for calculation of entropies, heat capacities, heat content functions, and free energy functions. From flow-type measurements, Knudsen effusion studies, mass spectral observations, and direct boiling point measurements, it is possible to establish the stabilities of gaseous molecules like $Be(OH)_2$, HOBO, $Zn(OH)_2$, $B(OH)_3$, H_2WO_4, B_2O_3, B_2O_2, Al_2O, AlO, Mo_3O_9, and W_5O_{15}. (auth)

21445

THERMOCHEMISTRY AND THERMODYNAMIC FUNCTIONS OF SOME BORON COMPOUNDS. W. H. Evans, E. J. Prosen, and D. D. Wagman (National Bureau of Standards, Washington, D. C.). p.226-35 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The current interest in boron compounds as components of high-energy fuels has stimulated an interest in the thermodynamic properties of the compounds comprising the boron-hydrogen-oxygen system. The available spectroscopic and molecular structure data have been used to calculate the free energy function, heat content function, entropy, heat content, and heat capacity for the gaseous species B, BO, B_2O_2, B_2O_3, B_2H_6, B_5H_9, $B_{10}H_{14}$, HBO_2, H_3BO_3, BF_3, and BCl_3. Low- and high-temperature heat-capacity and heat-content data were used in calculating the thermodynamic functions for B, B_2O_3, B_5H_9, and $B_{10}H_{14}$ in the solid and liquid states. Various equilibrium and thermochemical data have been used to calculate or estimate values for the heats of formation for these compounds. In many cases the data available are unsatisfactory or fragmentary; regions where new or more extensive data would be desirable are indicated. (auth)

21446

THE COMBUSTION OF BORON HYDRIDES. W. G. Berl and W. Renich (Johns Hopkins Univ., Silver Spring, Md.). p.236-50 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The currently available information on the combustion of boron hydrides is reviewed. In contrast to more conventional fuels (hydrocarbons, carbon monoxide, hydrogen, etc.), the quantity of pertinent research is small, even though, or perhaps because, the problems to be solved are more numerous and complex. This comparative lack of information is, in part, due to the fact that the technology of boron hydrides has only recently assumed a position of importance, and that many of the more basic chemical and physical problems connected with this class of compounds are only now being solved. (auth)

21447

THERMAL CONDUCTIVITY OF SOME EPOXY PLASTICS. J. E. Janssen and R. H. Torborg (Minneapolis-Honeywell Regulator Co., Hopkins, Minn.). p.284-90 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

A steady state and a transient technique requiring a minimum of specialized equipment were developed for measuring the thermal conductivity and thermal diffusivity of castable plastic materials. The results of

measurements made on five different filled epoxy plastics are presented and compared. The steady state technique was also used to measure the thermal conductivity of two epoxy foams. The effect of the degree of cure on the thermal conductivity was investigated and it was found that maximum cure raised the conductivity 5%. Gamma irradiation also increased conductivity about 5%. (auth)

21448

EXPERIMENTS IN THE MOLECULAR DIFFUSION OF GASES AT HIGH TEMPERATURES. A. A. Westenberg and R. E. Walker (Johns Hopkins Univ., Silver Spring, Md.). p.314-20 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

While the kinetic theory of dilute gases has led to fairly thorough understanding of the transport properties of gases in principle, the lack of experimental data in this field has seriously handicapped the actual prediction of the transport coefficients—especially at high temperatures—since the theory relies on experimental evaluation of potential parameters. The situation is particularly bad in the case of molecular diffusion, where data have been practically nonexistent above room temperature. Conventional measuring techniques are discussed and the drawbacks to their use at high temperature are pointed out. A new technique which is useful up to fairly high temperatures (1200°K) is described. The method makes use of a trace stream of one gas steadily injected from a fine tube ("point" source) into a slow laminar stream of a second gas. Measurements of the trace gas concentration down stream of the source by precise gas sampling permit the binary diffusion coefficient to be determined. Results on He–N_2 over a range of temperature from 300 to 1200°K are presented and are interpreted in terms of intermolecular potential functions and rigorous kinetic theory. It is shown how the diffusion coefficient of He–N_2 may be predicted with some reliability up to very high temperatures, by making use of the scattering potential. (auth)

21449

THE VISCOSITY OF STEAM. F. A. Thomas, Jr. and T. W. Jackson (Georgia Inst. of Tech., Atlanta). p.339-45 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The dynamic viscosity of steam was determined by combining data obtained with three different annulus-type viscometers used in this investigation and data obtained by Jackson with another annulus-type viscometer. The data are compared with viscosities presented by the Russian steam tables and the U. S. National Bureau of Standards. (auth)

21450

THE VISCOSITY OF STEAM–NITROGEN MIXTURES AT ATMOSPHERIC PRESSURE AND ELEVATED TEMPERATURES. C. F. Bonilla, S. E. Greer, and E. A. Taikeff (Columbia Univ., New York). p.346-9 of Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The viscosity of 50 mole percent mixtures of water vapor and nitrogen was measured by a capillary efflux viscometer from 345 to 860°C, at pressures slightly above atmospheric. The viscosity of the mixture averaged 1.5% higher than that of pure steam. It is concluded that mixtures high in water vapor, such as the combustion products of petroleum products burned with oxygen, have a viscosity close to that of water vapor. (auth)

21451

FLUID THERMAL CONDUCTIVITY BY A TRANSIENT METHOD. P. H. G. Allen (British-Thomson-Houston Co., Ltd., Rugby, Eng.). p.350-7 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The development of the line source transient method for measuring thermal conductivity is reviewed from Stalhane and Pyk 1931 to the present time and a recent improvement described. In this, observation of the temperature rise of a fine platinum wire emitting thermal energy at a constant rate over very short time intervals gives the thermal conductivity of the ambient medium. The variation with temperature of the thermal conductivity of transformer oil when measured in this way differs from that previously postulated. A brief investigation was therefore made into the possibility of an interaction between thermal and electric fields affecting the accuracy of the steady-state form of thermal conductivity apparatus. (auth)

21452

THERMAL EXPANSION COEFFICIENTS OF BINARY SUBSTITUTIONAL SOLID SOLUTION ALLOYS. W. M. Spurgeon (General Electric Co., Cincinnati). p.372-6 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The following equation has been derived for the mean linear coefficient of thermal expansion of binary substitutional solid solution alloys: $\alpha_\alpha = (x_1\alpha_1V_1 + x_2\alpha_2V_2)/(x_1V_1 + x_2V_2)$, where x_1 and x_2 are the mole fractions of the alloying elements, α_1 and α_2 are the mean coefficients of expansion of the elements, and V_1 and V_2 are their atomic volumes. The derivation is based on the assumptions of essentially isotropic structures and, as a first approximation, additivity of atomic volumes. The equation was tested on a series of 5 Cu–Ni alloys cast for this work. Compositions ranged from 20.1% Ni–79.9% Cu to 80.0% Ni–20.0% Cu. For the temperature ranges 25 to 500°C, 25 to 800°C, and 25 to 1000°C, the largest value of the average per cent difference between calculated and observed values of α_α was 5.4%. Individual differences ranges up to 7.3%. The equation was also tested on 5 Cu–Ni alloys reported by Aoyama and Itô, for the temperature range –182 to 0°C. The average per cent difference between calculated and observed values was 3%. Although the thermal expansions of the Cu–Ni alloys generally lie between the α-values of the two elements and generally increase regularly with the Cu content, they do not quite increase in the linear way predicted by the equation. A further test was made on 3 Ti–Zr alloys reported by Oxx for the temperature range 25 to 500°C. For these alloys the average per cent difference between calculated and observed values was only –1.1%, despite the anisotropic expansions of Ti and Zr. (auth)

21453

THERMAL CONDUCTIVITY OF AIRCRAFT STRUCTURAL AND REACTOR MATERIALS. I. B. Fieldhouse (Illinois Inst. of Tech., Chicago). p.391-9 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The thermal conductivity of eleven materials which may have application in aircraft structures or reactors has been determined as a function of temperature. The thermal conductivity of five of the materials was determined by means of a single plate method and the conductivity of the remaining six was measured by the radial heat flow method. (auth)

21454

THE TOTAL EMISSIVITY OF AIRCRAFT CONSTRUCTION MATERIALS. J. C. Morris, B. Schurin, and O. H. Olson (Illinois Inst. of Tech., Chicago). p.400-4 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

The total normal emissivities of various pure metals and alloys as a function of temperature have been investigated. Measurements were conducted by employing a calibrated thermistor bolometer as a total radiation detector. The measurements covered a temperature range extending from −320 to +2500°F. Two laboratory black-bodies used in the calibration of the system are described. Measurements were carried out in a vacuum in order to preserve initial surface conditions of the samples. Results are presented for pure Mo, Ta, Pt, Cu, stainless steels No. 316 and AM350, Inconel X and aluminum 24ST. (auth)

21455

SPECIFIC HEAT OF MATERIALS. J. I. Lang (Illinois Inst. of Tech., Chicago). p.405-14 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Results of specific heat measurements over the temperature range of 300 to 3000°F, by the drop calorimeter method are presented. Measurement of heat content was done in a modified Parr calorimeter. A discussion of the apparatus and operational methods is also presented. An estimate of the accuracy of the results is appended to the discussion of the results. (auth)

21456

MECHANIZED COMPUTATION OF THERMODYNAMIC TABLES AT THE NATIONAL BUREAU OF STANDARDS: THE CALCULATION OF THE EQUILIBRIUM COMPOSITION AND THERMODYNAMIC PROPERTIES OF DISSOCIATED AND IONIZED GASEOUS SYSTEMS. J. Hilsenrath, M. Klein, and D. Y. Sumida (National Bureau of Standards, Washington, D. C.). p.416-37 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

A high-speed computing method is described for the solution of the non-linear equations defining chemical equilibrium in homogeneous gaseous reactions. The method which is quite general operates directly on the product equations, rather than the linearized form, over a wide range of temperatures (1000 to 25,000°K) and densities (from 10^{-6} to 300 times normal) where dissociation and ionization occur. The IBM 704 program described here handles 40 or more reactions involving one or more of 5 elements and free electrons. The solution over the entire field of the two independent variables proceeds automatically from an initial guess of the concentration of the 5 atomic species and the electrons at the first computed point. The program provides: the compositions, the number of moles, internal energy, enthalpy, entropy, and pressure, from which auxiliary programs generate the specific heats, specific heat ratio, isentropic expansion coefficient, and sound velocity. An appendix to the paper gives an indexed bibliography of compilations of ideal gas thermal function for the elements, and their oxides, hydrides, borides, carbides, fluorides, and nitrides. (auth)

21457

EQUILIBRIA IN C + H_2 AND C + $2H_2$ SYSTEMS AT TEMPERATURES BETWEEN 1000 K AND 6000 K. H. Kroepelin and E. Winter (Technische Hochschule, Brunswick, Ger.). p.438-52 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Liquid hydrocarbons are decomposed primarily into acetylene, ethylene, and hydrogen by the action of electric arc discharges. Investigations on the influence of the pressure in the reaction vessel, the arc current strength, the chemical composition of the decomposed material, and the temperature of the liquid by hydrocarbon which is to be decomposed have already been carried out and presented in the literature. In the present work, the influence of the temperature existing in the arc on the state of the chemical equilibrium which occurs in the gas phase of the arc will be investigated. Soot formation will be taken into account in the calculation. In addition, the influence of the total pressure in the system on the final appearance of equilibrium will be calculated in an approximate manner. (auth)

21458

EQUILIBRIA IN A THERMAL PLASMA COMPOSED OF C + H_2 AND C + $2H_2$ IN A TEMPERATURE RANGE FROM 5000 K TO 50,000 K AT A TOTAL PRESSURE OF 1 BAR. H. Kroepelin, and K. K. Neumann (Technische Hochschule, Brunswick, Ger.). p.453-64 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Investigations were carried out on the decomposition of liquid hydrocarbons by small electric arc discharges. The temperatures of these arcs were measured spectroscopically. Therefore, it was necessary to determine the composition of the thermal plasma resulting from a C + H_2 and C + $2H_2$ system in the temperature range from 5000 to 50,000°K at a total pressure of 1 bar. The equilibrium existing in the plasma may be calculated according to the Eggert-Saha equation. However, it must be determined whether or not the ion density in the plasma reduces the ionization energy. (auth)

21459

MOLLIER ENTHALPY-ENTROPY CHARTS FOR HIGH-TEMPERATURE PLASMAS. F. Bosnjakovic, W. Springe, K. F. Knoche, and P. Burgholte (Technische Hochschule, Brunswick, Ger.). p.465-72 of "Thermodynamic and Transport Properties of Gases, Liquids and Solids."

Energy changes and heat transfer in high-temperature gaseous plasma flows are becoming increasingly important in technology. Mollier enthalpy-entropy diagrams have proved to be valuable tools in this development. Enthalpy-entropy diagrams for hydrogen and argon plasmas at temperatures up to 100,000°K and for pressures from 0.01 to 100 atm are presented. The diagrams are shown with lines of constant pressure, density, temperature, and sonic velocity. These graphs are further plotted in logarithmic co-ordinates in order to present the low-temperature region more clearly. The diagrams are only valid for plasmas existing in thin layers where the energy and entropy content of the enclosed radiation is not important. Radiation must be taken into account for plasma layers of large thickness. As an example of the application of these charts, the stagnation temperature of a body flying at 8,000 meters/sec in a hydrogen or argon atmosphere at 0.01 atm pressure and 300°K temperature is calculated. For the case of a hydrogen atmosphere, the wall temperature at the stagnation point T_w = 2000 K (wall radiation neglected) and T_w = 1820 K (with wall radiation). In argon, these values are 16,500 K without and 5800 K with wall

radiation. The great importance of both the medium and the wall radiation is apparent. In these calculations it is assumed that no magnetic or electric field exists. (auth)

21460

THE GRAETZ-NUSSELT PROBLEM (WITH EXTENSION) FOR A BINGHAM PLASTIC. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-41. E. H. Wissler and R. S. Schechter (Univ. of Texas, Austin). New York, Engineers Joint Council, 1959, 23p. $0.50.

The Graetz-Nusselt problem is extended to include heat transfer to a slurry which behaves as a Bingham plastic. The eigenvalues, normalized expansion coefficients for constant inlet temperature, and the norms of the orthogonal functions are tabulated. These values permit the computation of heat fluxes and average fluid temperatures with and without internal heat generation. (auth)

21461

IMPROVEMENTS IN OR RELATING TO STEAM GENERATORS. Palle Clifford Ostergaard and Robert Keelzie Sayre (to Westinghouse Electric International Co.). British Patent 816,744. July 15, 1959.

A compact portable steam generator is described. A primary coolant fills a spherical vessel in which water-filled tubes and the heat source are placed. Thus leaks in the water-filled tubes do not allow water to contact the heat source. The steam generating tubes are divided into groups which can be isolated. The compact design allows use of expensive corrosion-resistant materials. (T.R.H.)

Nuclear Properties and Reactions

21462 AECU-4336

Harvard Univ., Cambridge, Mass. Lyman Lab. of Physics.

THE RADIOACTIVITY OF Sb^{125} AND Te^{125m}. Technical Report No. 2-9. Rocco Sandy Narcisi. Oct. 21, 1958. 143p. Sponsored by ONR and AEC under Contract Nonr-1866(19). (AD-217161). $22.80(ph), $7.20(mf) OTS.

The radioactivity of Sb^{125} (2.4 yr) and its daughter, Te^{125m} (58 day), was studied with a double-focusing magnetic spectrometer. Prompt gamma-gamma coincidences in Te^{125} were studied with a sodium iodide scintillation coincidence spectrometer. K conversion intensities, conversion ratios, and properties of the beta spectrum were determined by a study of the electrons emitted by an Sb^{125} source. Transition energies were measured absolutely by a comparison with the standard internal conversion lines of ThB. Gamma-ray transitions and their intensities were determined by examining the secondary electrons ejected by the gamma rays from thorium and tantalum converter foils. Some high-resolution studies on the internal conversion lines of Te^{125m} were made. As a result, a total of 16 gamma-ray transitions were found in Te^{125} at energies: 35.6, 109, 109.4, 171, 176.3, 203, 206, 319, 379.1, 426.5, 461.8, 598.2, 604.1, 633.6, 652, and 667.8 kev. From a consideration of the decay scheme, the relative intensities of the gamma rays and the actual beta spectrum, eight beta-ray transitions were found with end points and intensities: 96 kev (2.2%), 112 kev (<0.8%), 124 kev (5.9%), 131 kev (30.5%), 240 kev (1.0%), 302 kev (40.4%), 443 kev (5.9%) and 619 kev (13.4%). On the basis of prompt gamma-gamma coincidence studies, intensity data, measured internal conversion coefficients, conversion ratios, beta-ray end points, ft values, and the measured transitions energies, a consistent level scheme for Te^{125} is proposed. With these measurements, the multipolarity of the transitions and the spins and parities of the nuclear levels in Te^{125} are determined. The results indicated nuclear states in Te^{125} at energies (spin and parity in parentheses): 0 kev ($\frac{1}{2}$+), 35.6 kev ($\frac{3}{2}$+), 145.0 kev ($1\frac{1}{2}$-), 321.3 kev ($\frac{3}{2}$-), 462.0 kev ($\frac{5}{2}$+), 524.1 kev ($\frac{1}{2}$- or $\frac{3}{2}$-), 633.6 kev ($\frac{5}{2}$+), 639.7 kev ($\frac{7}{2}$+), 652 kev (?), and 667.8 kev ($\frac{5}{2}$+). A comparison of the level scheme of Te^{125} is made with the predictions of several nuclear models. (auth)

21463 AFCRC-TN-59-259

New York Univ., New York. Inst. of Mathematical Sciences.

LOW ENERGY SCATTERING BY A COMPOUND SYSTEM: *POSITRONS ON HYDROGEN.* *Larry Spruch and* Leonard Rosenberg. Feb. 1959. 53p. Contract AF19(604)-4555. (CX-40; AD-212556).

The formalism, developed by Kato, which gives upper and lower bounds on the phase shift for the scattering of a particle from a center of force is shown to have useful applications when the scatterer is a compound system. In particular, the problem of low-energy positron scattering from atomic hydrogen, with zero total orbital angular momentum, is studied. It is shown that at zero energy the ordinary variational calculation, which ignores second order contributions, provides a bound on the scattering length, from which a bound on the cross section is deduced. For non-zero energies a bound on the phase shift may similarly be obtained, but for a fictitious problem with cut-off potentials. If the energy is sufficiently small the error thus incurred is expected to be negligibly small. Numerical calculations performed at $k = 0$ and $kr_0 = 0.2$ lead to the result that the effects of polarization are large enough to cause the positron to be on the whole attracted to the hydrogen atom. It is shown, independently of the Kato formalism, that in general a bound on the scattering length may be obtained from the ordinary variational calculation provided no composite bound state exists for the system. (auth)

21464 CF-59-8-111

Oak Ridge National Lab., Tenn.

CALCULATION OF EFFECTIVE RESONANCE INTEGRALS. S. Jaye. Aug. 28, 1959. 12p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Effective resonance integrals for fuel and fertile materials were calculated as a function of material concentration in homogeneous media. For the fissile materials (U^{235}, Pu^{239}), results were obtained from multigroup, Monte-Carlo, and statistical-model calculations. The multigroup results indicated very little self-shielding; the results from Monte-Carlo and statistical-model calculations were in good agreement. Because of this agreement and its simplicity, the statistical-model calculation seems best at this time. For the fertile materials (U^{238}), results were obtained from Monte-Carlo and multigroup calculations and were compared with experimental results. The multigroup calculation did not demonstrate sufficient self-shielding of the large resonances. The Monte-Carlo calculation gave the correct relative variation of the resonance integral but suffered from insufficient cross-section data. (auth)

21465 CRC-852
Atomic Energy of Canada Ltd., Chalk River, Ont.
FAST NEUTRON REACTIONS AND FAST NEUTRON FLUX IN THE NRX REACTOR. J. C. Roy and D. Wuschke. July 1959. 31p. (AECL-877). $1.00 (AECL).

Experimental values of 10 (n,2n), 24 (n,p), and 15 (n,α) cross sections and a graph to estimate any (n,2n) cross section are given. The maximum fast neutron flux in NRX was determined to be 4.4×10^{12} n/cm^2-sec. The ratio of fast to thermal flux is constant in the irradiation positions in the core of NRX and is equal to $1/18$. (W.D.M.)

21466 CRRP-862
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
SUPPLEMENT TO "EFFECTIVE CROSS SECTION VALUES FOR WELL-MODERATED THERMAL REACTOR SPECTRA." C. H. Westcott and D. A. Roy. Aug. 20, 1959. 23p. (AECL-869). $0.50(AECL).

The compilation of effective cross sections (CRRP-787) included neutron temperatures up to 760°C. Values are presented up to 1280°C. The validity of the low-energy cut-off of the epithermal neutron spectrum assumed in CRRP-787 was also examined. Calculations are repeated for some of the more important elements for cut-off functions of 4 and 3 kt. (W.D.M.)

21467 NARF-59-33T
Convair, Fort Worth, Tex.
ANALYSIS OF THE MOMENTS METHOD EXPERIMENT. R. L. Kloster. Sept. 4, 1959. 35p. Project 6(1-9964). Contract AF33(600)-38946. (FZK-9-138).

Monte Carlo calculations show the effects of a plane water-air boundary on both fast neutron and gamma dose rates. Multigroup diffusion theory calculation for a reactor source shows the effects of a plane water-air boundary on thermal neutron dose rate. The results of Monte Carlo and multigroup calculations are compared with experimental values. The predicted boundary effect for fast neutrons of 7.3% agrees within 16% with the measured effect of 6.3%. The gamma detector did not measure a boundary effect because it lacked sensitivity at low energies. However, the effect predicted for gamma rays of 5 to 10% is as large as that for neutrons. An estimate of the boundary effect for thermal neutrons from a PoBe source is obtained from the results of multigroup diffusion theory calculations for a reactor source. The calculated boundary effect agrees within 13% with the measured values. (auth)

21468 NYO-2236
Carnegie Inst. of Tech., Pittsburgh.
μ-MESON CAPTURE IN Li^6 LEADING TO THE GROUND STATE OF He^6. H. Überall. Apr. 1959. 30p. Contract AT(30-1)-882. $6.30(ph), $3.00(mf) OTS.

The rate of the capture reactions of μ^--mesons in Li^6 leading to the He^6 ground state is calculated, a process which is expected to give more accurate information on the μ-capture coupling constants than the capture in nuclei leading to all possible final states. Induced pseudoscalar coupling and Gell-Mann's conserved vector current are taken into account, and numerical results are given assuming a universal weak interaction. The Li^6 and He^6 wave functions are taken as shell model states with LS coupling and configuration mixing. It is found that the capture rate is sensitive to the p-shell radius, and for a determination of the latter, the Stanford electron scattering results for Li^6 were analyzed taking into account the recoil motion of the α-particle core; however, the main portion of the radial integral in the theoretical capture rate can be read off the scattering data directly. The capture rate is found to be of the order of 0.4×10^3 sec^{-1}, its exact value still depending on some assumptions about the coupling. (auth)

21469 AEC-tr-3819
MEDIUM ENERGY NUCLEAR REACTION SECTION—PRODUCTION OF NARROW SPECTRUM PHOTONS FROM HIGH ENERGY ELECTRONS. (Production de Photons de Spectre Étroit à Partir d'électrons de Grande Énergie.) C. Tzara. Translated from report CEA-814, Mar. 1958. 17p. $3.30(ph), $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 9095.

21470 UCRL-Trans-493
THE MEASUREMENT OF THE LENGTHS OF INTERVALS BETWEEN THE ACTS OF RADIOACTIVE DECAY AS A POSSIBLE WAY FOR THE IDENTIFICATION OF NEW TRANSURANIC ELEMENTS. V. I. Gol'danskii and M. I. Podgoretskii. Translated for Univ. of Calif. Radiation Lab. from Zhur. Eksptl'. i Teoret. Fiz. 37, 315(1959). 5p. $1.80(ph), $1.80(mf) JCL or LC.

A simple method of determining the genetic connection between a parent isotope A and a daughter isotope B having a longer life span is suggested. The method is based on measuring the duration of intervals between two adjacent acts of decay of B and between the acts of decay of A and B adjacent to them. Quantitative expressions are given which permit identification of new transuranic elements. (W.D.M.)

21471
ISOTOPIC SPIN. J. P. Davidson (Rensselaer Polytechnic Inst., Troy, N. Y.). Am. J. Phys. 27, 457-65 (1959) Oct.

The isotopic (or isobaric) spin formalism, so important in nuclear structure and meson problems, is developed. After a short introduction the Pauli theory of mechanical spin is reviewed and used to develop the isotopic spin formalism along parallel lines. Examples of the formalism's applications to beta decay and nuclear reaction problems are given. (auth)

21472
μ MESON AND THE CATALYSIS OF NUCLEAR REACTIONS. N. D'Angelo (Argonne National Lab., Lemont, Ill.). Am. J. Phys. 27, 466-9(1959) Oct.

A summary is given of the few experimental and theoretical studies of μ mesons as catalyzers of nuclear reactions between hydrogen isotopes. Present indications are that this is not likely to be practical for the production of power. (auth)

21473
ON THE RADIOACTIVE BETA DISINTEGRATION ENERGY OF P^{32}, S^{35}, Pm^{147}, Ca^{45}, AND Pr^{143}. Väinö Hovi (Univ. of Turku, Finland). Ann. Acad. Sci. Fennicae Ser. A, VI, No. 16, 1-14(1959).

A survey is presented of the calorimetric radioactivity measurements carried out after the review article published by Myers in 1949. The data obtained previously by means of different methods for the mean energy, $\overline{E}_\beta$, of the beta particles of the isotopes of P^{32} and S^{35} are re-examined. It is shown that all the modern values of $\overline{E}_\beta$ determined from the beta spectra, calorimetric measurements, and from the Fermi theory

are in good agreement. For the isotopes Pm^{147}, Ca^{45}, and Pr^{143} predictive values of $\overline{E}_\beta$ are calculated from the available beta spectrum (Pm^{147}), and from the Fermi theory (Pm^{147}, Ca^{45}, and Pr^{143}). These predictive values are important for future precision calorimetric investigations at low temperatures. (auth)

21474

ANGULAR DISTRIBUTION OF POLARIZED ELECTRONS EMITTED FROM ORIENTED NUCLEI. Hormoz Mahmoud (Iowa State College, Ames). Ann. Phys. (N. Y.) 7, 429-39(1959) Aug.

A procedure first used by Rose and Osborn is applied to the calculation of the angular distribution of polarized electrons emitted from oriented nuclei. The final result is an exact expression in which the only unknown quantities are the reduced matrix elements. The latter can be evaluated only after a definite nuclear model is adopted. (auth)

21475

A SHELL MODEL CALCULATION WITH REACTION MATRIX. Manoj K. Banerjee and Binayak Dutta Roy (Saha Inst. of Nuclear Physics, Calcutta). Ann. Phys. (N. Y.) 7, 484-503(1959) Aug.

While explaining the success of the shell model of the nucleus, the Brueckner theory of nuclear many body problem prescribes that the reaction matrix should be used in setting up the shell model hamiltonian. The theory shows how the reaction matrix between two nucleons inside a nucleus can be calculated if the interaction potential between two free nucleons is known. So far no shell model calculation has been performed with such a reaction matrix, mainly because its evaluation in a finite nucleus is an extremely laborious task. In this paper an approximate form for the reaction matrix has been used to calculate the level spacings of Ca^{42}. The reaction matrix has been parametrized with two quantities. One is the correlation length and the other is a quantity related to the effective mass. Reasonable agreement between the experimentally measured level spacings and the theoretical values are obtained for values of the two parameters which are consistent with the estimates of these quantities based on the studies of the properties of nuclear matter. (auth)

21476

ELECTRON POLARIZATION IN FIRST FORBIDDEN BETA TRANSITIONS WITH SPIN CHANGE $\Delta J \pm 1$. B. Kuchowicz. Bull. acad. polon. sci., Sér. sci., math., astron. et phys. 7, 289-93(1959).

Electron polarization is investigated in first forbidden beta transitions with spin change $\Delta J = \pm 1$. General expressions are derived for the universal Fermi interaction with two complex coupling constants C_V and C_A. (C.J.G.)

21477

A STUDY OF $F^{19}(n,d)O^{18}$ AND $P^{31}(n,d)Si^{30}$ REACTIONS WITH 14.1 Mev NEUTRONS. G. E. Velyukhov, A. N. Prokofiev, and S. V. Starodubtsev (Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 781-3(1959) Aug. 1. (In Russian)

Reactions $F^{19}(n,d)O^{18}$ and $P^{31}(n,d)Si^{30}$ with 14.1 Mev neutrons were studied with neutrons from $T(d,n)He^4$ reactions at 260 kev. The neutron flux of 5×10^9 neutrons/4π was monitored with a proportional counter filled with BF_3; absolute measurements were made by recording α particles, with a CsI(Tl) crystal counter. The deuteron energy spectra and angular distribution at $\theta = 0°$ was correlated with the energy of recoil deuterons from a zirconium deuteride target. The magnitude -5.9 ± 0.3 Mev was obtained for the Q. The angular distribution of deuterons corresponding to the transition to the O^{18} nucleus ground state was plotted according to previously published data for $r_0 = 5 \times 10^{-13}$ cm and $l = 0$. The energy and angular distributions of deuterons from the $P^{31}(n,d)Si^{30}$ reactions were plotted and Q for the transition to the ground state is -5.2 ± 0.2 Mev. The transition to the Si^{30} ground state corresponds to $l = 0$. P^{31} has spin $\frac{1}{2}^+$ and Si^{30} has spin 0^+, consequently only s-wave pick-up shows in the reaction. The angular distribution is in good agreement with Butler's theory. The width of the θ^2 transition to the Si^{30} ground state is 0.054. The similarity between the reaction $F^{19}(n,d)O^{18}$ and $P^{31}(n,d)Si^{30}$ is stressed. (R.V.J.)

21478

PROTON MAGNETIC RESONANCE IN TITANIUM AND ZIRCONIUM HYDRIDES. O. T. Malyuchkov and B. N. Finkel'shtein (Stalin Moscow Inst. of Steel). Doklady Akad. Nauk S.S.S.R. 127, 822-4(1959) Aug. 1. (In Russian)

Proton magnetic resonance in titanium and zirconium hydrides was measured in a magnetic field of 21449 k hertz frequency and 5035 gauss field intensity. Specimens of powdered hydrides with hydrogen contents $TiH_{1.98}$, $TiH_{1.75}$, $TiH_{1.05}$, $TiH_{0.95}$, $TiH_{0.85}$, $TiH_{0.50}$, $TiH_{0.20}$, and ZrH_2 were prepared in a vacuum at various temperatures. Titanium hydrides with less than 20 at. % H are single-phase hydrides with hexagonal lattices with $a/c = 1.62$; with 20 to 55 at. % H the hydrides become two-phase with a hexagonal α phase and face-centered cubic β phase. With hydrogen content exceeding 55 at. % the hydrides are single phased with a face-centered cubic lattice and increasing periods from 4.40 to 4.45 kX. Proton paramagnetic resonance expands in hydrogen-rich β hydrides, indicating slowed proton motion and alterations in hydrogen-metal bonds. The second and fourth p.m.r. moments in $TiH_{1.98}$ and ZrH_2 were measured and correlated with the values for the second moments in molecular hydrogen diffused into octahedron and tetrahedron pores and for separate proton diffusion into tetrahedron pores. The second moment for titanium and zirconium hydrides was found to approximate that of proton diffusion into the tetrahedron pores. The difference in the calculated and experimental magnitudes for $TiH_{1.98}$ and ZrH_2 second moments indicates a difference in the bonds between protons and metal atoms. It is assumed that the covalent bond of ZrH_2 induces the tetrahedron distortion of the lattice, while the metallic bond of $TiH_{1.98}$ produces a more symmetric cubic lattice. (R.V.J.)

21479

DYNAMIC POLARIZATION OF SILICON-29 AT LOW TEMPERATURES. J. Combrisson and I. Solomon (Centre d'Études Nucléaires, Saclay, France). J. phys. radium 20, 683-90(1959) July. (In French)

Dynamic polarization of nuclei of silicon-29 in silicon was studied at liquid-helium temperature. Experimental results and apparatus are described. (auth)

21480

THE DECAY CHAIN $Ge^{73} \xrightarrow{\beta^-} As^{73}$. C. Ythier and A. H. W. Aten, Jr. (Instituut von Kernphysich Onderzoek, Amsterdam). J. phys. radium 20, 694-6(1959) July. (In French)

Ge^{73} produced by the reaction $Se^{82}(n,\alpha n)Ge^{73}$ with 30 Mev neutrons was isolated by chemical means. Its

half life was determined by successive milkings using different chemical procedures and was found to be 2.1 ± 0.1 hours, in disagreement with earlier results. (auth)

21481

SCATTERING OF π-MESONS ON He-3 AND He-4. N. V. Dushin (Leningrad Polytechnic Inst.). Nauch. Doklady Vysshei Shkoly, Fiz.-Mat. Nauki, No. 2, 162-5(1958).

An attempt is made to determine the cross section of the reaction: $\pi + He^3 \rightarrow n_1 + n_2 + n_3 + \pi'$ as well as the same formula for He^4. The wave function of the initial state is considered to be a superposition of states with isotopic spin $T = \frac{1}{2}$ and $\frac{3}{2}$. The wave function of the final state may be constructed from the wave function of a three-nucleon system (isotopic spin $t = \frac{1}{2}$ and $\frac{3}{2}$) and from the wave function of the π-meson (isotopic spin equal to unity). The correlations between the differential cross sections are derived.

21482

PAIR FORMATION OF K-MESONS AT COLLISIONS OF π-MESONS WITH NUCLEONS AND DEUTERONS. N. V. Dushin (Leningrad Polytechnic Inst.). Nauch. Doklady Vysshei Shkoly, Fiz.-Mat. Nauki, No. 2, 166-8(1958).

Strange particles with strangeness S = +1 for K^+ and K^0 and with strangeness S = −1 for K^- and K^0 are analyzed. Reactions in which K-mesons with strangeness S = +1 occur should also contain a particle with strangeness S = −2. By taking into consideration the conservation law of the number of particles, a particle with S = −2 may be only a cascade hyperon (Ξ). The differential cross section of the process $\pi + n \rightarrow \Xi + K + K'$ is determined and correlations between total cross sections of π-mesons on nucleons and deuterons are derived.

21483

THE OVERHAUSER EFFECT IN METALLIC LITHIUM. Ye. I. Kondorskii and N. A. Bekeshko (Moscow State Univ.). Nauch. Doklady Vysshevi Shkoly, Fiz.-Mat. Nauki, No. 2, 204-7(1958).

To clarify the relation of polarization of nuclei to the saturation degree of resonance, bound to conducting electrons, the amplitude of the signal of nuclear resonance at various strengths of the high-frequency magnetic field of the oscillator was measured. Apparatus and methods applied were described by the authors in previous articles (Zhur. Eksptl'. i Teoret. Fiz., 32, 611(1957)). The results obtained are plotted in graphs. They show that the amplitudes of the signal of the nuclear resonance increase when the frequency varies from 77 to 83.6 Mc, but decreases thereafter.

21484

INDUCED ANTIMONY ACTIVITY IN MYLAR. C. A. Accardo, H. W. Hendel, R. G. Lauttman, and M. N. Stein (Army Signal Research and Development Lab., Fort Monmouth, N. J.). Nucleonics 17, No. 9, 106(1959) Sept.

Irradiated Mylar films were found to become activated because of the presence of antimony in the material. The 60-day Sb^{124} was produced in an (n,γ) reaction with Sb^{123} and 2.8 day Sb^{122} was produced in an (n,γ) reaction in Sb^{121}. Calculations showed the amount of antimony in the samples to be about 200 ppm by weight. (C.J.G.)

21485

INELASTIC ELECTRON SCATTERING FROM CARBON. W. C. Barber and F. E. Gudden (Stanford Univ., Calif.). Phys. Rev. Letters 3, 219-21(1959) Sept. 1.

The energy spectrum of electrons inelastically scattered from nuclei was measured, with the aim of studying the giant-resonance region of nuclear excitation. Scattered electrons corresponding to excitation of the giant resonance were observed at large angles for targets of Si and C. The scattering distribution from C was investigated in detail, and a peak at 15 Mev was observed. The Mark II linear accelerator and an 18-in. double-focusing spectrometer were used for the experiment. (W.D.M.)

21486

NUCLEAR RESONANCE ABSORPTION OF GAMMA RAYS IN Ir^{191}. P. P. Craig, J. G. Dash, A. D. McGuire, D. Nagle, and R. R. Reiswig (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 3, 221-3(1959) Sept. 1.

Mössbauer demonstrated the existence of nuclear resonance absorption of the 129-kev gamma ray of Ir^{191} in metallic Ir with source and absorber at a temperature of 88°K. Mössbauer's measurements are repeated, with extension of the temperature range to 1.5°K, measurements on various foil thicknesses, and a demonstration of semiquantitative agreement of the results with theoretical calculations by Visscher based upon a theory of Lamb. (W.D.M.)

21487

NUCLEAR RESONANCE ABSORPTION OF GAMMA RAYS AT LOW TEMPERATURES. L. L. Lee, Jr., L. Meyer-Schutzmeister, J. P. Schiffer, and D. Vincent (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 3, 223-5(1959) Sept. 1.

Recent experiments by Mössbauer have shown that nuclear resonance absorption of gamma rays can take place when both source and absorber are placed at liquid nitrogen temperature. The source used in his measurements was Os^{191} which decays to Ir^{191} with a 16-day half life. This beta decay populates a 4.9-sec isomeric state which cascades through the 129-kev excited state of this nucleus. The present experiment was designed to measure the lifetime of this excited state. (W.D.M.)

21488

LIFETIMES OF THE 118-kev AND 139-kev LEVELS OF Tm^{169} MEASURED BY A NEW METHOD. A. E. Blaugrund (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. Letters 3, 226-7(1959) Sept. 1.

The lifetimes of 118 and 139 kev rotational states in Tm^{169} were measured by a new method which is a variation on ideas suggested by Devons and Gerholm. With this method it is possible to measure lifetimes in the region 10^{-11} to 10^{-10} sec of levels situated between two low-energy highly converted gamma transitions. The method is described and results of measurements are discussed. (W.D.M.)

21489

BETA-SPECTROMETRIC STUDY OF THE ANGULAR DISTRIBUTION OF THE K-, L-, AND M+N+...-SHELL PHOTOELECTRONS FROM URANIUM. Sölve Hultberg and Ziemowid Sujkowski (Nobel Inst. of Physics, Stockholm). Phys. Rev. Letters 3, 227-9(1959) Sept. 1.

The longitudinal angular dependence of the K, L, and M + N+... shells was investigated by a beta-spectrometric study of the photoelectrons ejected from a thin uranium converter (2.19 ± 0.02 mg U/cm²) by the

action of unpolarized gamma radiation ($h\nu$ = 412, 662, and 1332 kev). The uranium foil of 14.6-mm diameter was placed at the ordinary source position in the double focusing beta spectrometer and the source was rotated around the foil center at a distance of 30 mm. (W.D.M.)

21490

INTERPRETATION OF "ANOMALOUS INELASTIC SCATTERING." C. D. Goodman (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 3, 230-1(1959) Sept. 1.

Cohen's arguments on (p,p′) reactions are examined in light of preliminary (p,d) data. It is suggested that the shell model may be a good description of the states involved in (p,p′) reactions. No attempt is made to calculate the relative intensities of the peaks. It is assumed that states due to the excitation of single particles appear in the (p,p′) spectra, and states due to the excitation of two or more particles are sufficiently inhibited to be unimportant in describing the gross features of the spectra. (W.D.M.)

21491

COMPLEX NUCLEON TRANSFER REACTIONS OF HEAVY IONS. Richard Kaufmann and Richard Wolfgang (Yale Univ., New Haven). Phys. Rev. Letters 3, 232-4(1959) Sept. 1.

The transfer of a single nucleon in heavy ion reactions involving N^{14} has been studied quite intensively. The results are consistent with a mechanism involving tunneling through the Coulomb barrier of nucleons Coulomb-excited to virtual levels. Some studies are discussed of high-energy reactions in which several nucleons are transferred. Target foils of Al, Sn, Cu, and Rh backed with gold catcher foils were irradiated with 160-Mev O^{16} and 140-Mev N^{14}. (W.D.M.)

21492

FISSION OF U^{238} INDUCED BY μ^- CAPTURE. Justo Diaz, Selig N. Kaplan, Burns MacDonald, and Robert V. Pyle (Univ. of California, Berkeley). Phys. Rev. Letters 3, 234-5(1959) Sept. 1.

It has been pointed out that there are two ways in which a μ^- meson stopped in uranium may induce nuclear fission. The energy released in the nonradiative transition of the mesonic atom to its 1s state as well as that liberated in the nuclear-capture process, $\mu^- + U^{238} \rightarrow Pa^{238} + \nu$, should be sufficient sometimes to induce fission. The preliminary results of an experiment performed to obtain the relative probabilities of the two meson-induced fission mechanisms are presented. The experimental setup is described. (W.D.M.)

21493

PARITY CONSERVATION IN HYPERON PRODUCTION BY 1.15-Bev/c K^- MESONS ON PROPANE. Richard L. Lander, Wilson M. Powell, and Howard S. White (Univ. of California, Berkeley). Phys. Rev. Letters 3, 236-7(1959) Sept. 1.

Several experiments have indicated a possible forward-backward asymmetry in the decay of Λ^0 hyperon. A recent exposure of the UCRL 30-inch propane bubble chamber to a 1.15-Bev/c separated K^- beam offers the opportunity to explore the question further. Several thousand K^- interactions were photographed. The initial results from a sample of 141 V^0 decays are reported. (W.D.M.)

21494

NOTES ON ANTIBARYON INTERACTIONS. A. Pais (Univ. of California, Berkeley). Phys. Rev. Letters 3, 242-4(1959) Sept. 1.

Some simple consequences of, or checks for, invariance considerations as applied to interactions of antibaryons are presented. Topics discussed include P conservation in strong interactions, C invariance of strong interactions, charge symmetry and charge independence, and $\bar{\Lambda}$ decay and T invariance. (W.D.M.)

21495

TRITIUM AS A PRODUCT OF FISSION. E. L. Albenesius (E. I. du Pont de Nemours and Co., Aiken, S. C.). Phys. Rev. Letters 3, 274-5(1959) Sept. 15.

Experiments are described which indicate that the triton is a previously unrecognized fission product. Tritium was shown to be present in a ratio of one triton per $(1-2) \times 10^4$ fissions in samples of irradiated natural and enriched uranium and in an irradiated mixture of transuranium isotopes. The Li content of the sample was proven not to be the source of the tritium. (W.D.M.)

21496

DISTRIBUTION OF TOTAL RADIATION WIDTHS OF Cu^{59}. J. H. Carver (Australian National Univ., Canberra) and G. A. Jones (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Rev. Letters 3, 276-7(1959) Sept. 15.

The reaction $Ni^{58}(p,\gamma)Cu^{59}$ was studied for proton energies up to 4.3 Mev. The spacing of the resonances for this reaction is unusually wide, being ~40 kev at E_p = 4.3 Mev. Isotopically separated targets of Ni^{58} were bombarded with protons from the Harwell electrostatic generator, the targets having a thickness of 3-Mev protons. (W.D.M.)

21497

SEARCH FOR HIGHER-ORDER EFFECTS IN ALLOWED BETA DECAY. R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys. Rev. Letters 3, 277-9(1959) Sept. 15.

The anisotropy values to be expected for beta-gamma cascades in Na^{24}, Sc^{48}, Co^{60}, and Na^{22} were computed using Morita's formulas. The values of experimental anisotropy were calculated by taking into account the reduction of $S\bar{\sigma}$ which was estimated on the basis of a nominal log ft value for an allowed transition of 4.5. Measurements of beta-gamma directional correlations were made with a vacuum chamber and scintillation counter arrangement. (W.D.M.)

21498

7.656-Mev E0 TRANSITION IN C^{12}. David E. Alburger (Oak Ridge National Lab., Tenn. and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 280-1(1959) Sept. 15.

7.656-Mev second excited state of C^{12} is involved in theories of helium burning and element synthesis in red giant stars. By means of an intermediate-image pair spectrometer the 7.656-Mev nuclear pair line was observed in the $Be^9(\alpha,n)C^{12}$ reaction. Singly-ionized helium was accelerated and then gas-stripped before entering the 90° deflecting magnet. Runs were made with beams of ~4μa of He^{++} at 5.38 and 5.81 Mev on thick targets and with a beam of ~1 μa of He^{++} at 5.81 Mev on a thin target. (W.D.M.)

21499

SOME ASPECTS OF THE DECAY SCHEME OF 54 MINUTE ^{116}In. R. K. Girgis and R. Van Lieshout (Instituut voor Kernphysisch Onderzoek, Amsterdam). Physica 25, 590-6(1959) July.

The gamma rays following the decay of 54-min In^{116} were examined with the help of scintillation spectrometers. A detailed analysis of the direct spectrum was performed. Coincidence relations were established by the summing method. The results were found to be in agreement with those reported by Slätis, duToit, and Siegbahn. The existence of the disputed 1.8-Mev gamma ray was confirmed and a level at 3.07 Mev in Sn^{116} is proposed as the origin of this gamma ray. The presence of a 3.08-Mev peak in the summing spectrum supports this interpretation. (auth)

21500

ON THE DECAY OF ^{112}In. R. K. Girgis and R. Van Lieshout (Instituut voor Kernphysisch Onderzoek, Amsterdam). Physica 25, 597-9(1959) July.

The gamma spectrum of the $In^{113}(n,2n)In^{112}$ reaction was studied. The spectrum above 800 kev decayed with the 54-min period of In^{116m}. The In^{116} peaks at 157 and 393 kev are assigned to 1.8 hour In^{113m} and 4.5 hour In^{115m}, respectively. The 511-kev peak showed a growth and decay curve consistent with the parent-daughter relation between a 22 min In^{112} isomeric state and an $\approx$ 11 min positron emitting In^{112} ground state. An explanation of the 710 kev peak is given. (C.J.G.)

21501

ENERGY MEASUREMENTS OF PROTON RESONANCES IN LIGHT NUCLEI. J. Kuperus, P. J. M. Smulders, and P. M. Endt (Fysisch Laboratorium der Rijksuniversiteit, Utrecht). Physica 25, 600-9(1959) July.

A search has been made for (p,γ) resonances in all stable nuclides from F^{19} through S^{32} for proton energies in the 0.20 to 0.85 Mev range. The energies of eighty-one resonances were measured with an average precision of 0.24 percent. Four new resonances, at 431.0 ± 1.3, 436.9 ± 1.3, 480.1 ± 1.0, and 725.5 ± 1.2 kev, were observed in the $Ne^{22}(p,\gamma)Na^{23}$ reaction, and one new resonance, at 501.4 ± 1.4 kev, was found in the $Mg^{26}(p,\gamma)Al^{27}$ reaction. (auth)

21502

A STUDY OF THE LEVELS IN ^{19}F FOLLOWING THE β-DECAY OF ^{19}O. C. M. P. Johnson, G. A. Jones, W. R. Phillips, and D. H. Wilkinson (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London) A252, 1-15(1959) Aug. 25.

The β-decay scheme of O^{19} to states of F^{19} was determined, and log ft values assigned to the individual transitions, by studying the γ rays following β decay. The decay schemes of the levels in F^{19} were elucidated by coincidence and angular correlation measurements. These measurements have enabled characteristics to be assigned to the excited states of F^{19}, and relative γ-transition probabilities were determined. The results are compared with theoretical calculations on the individual-particle model in intermediate coupling and on the collective model. (auth)

21503

THE UNIFIED MODEL FOR Si^{29}. S. P. Pandya (Physical Research Lab., Ahmedabad, India). Progr. Theoret. Phys. (Kyoto) 21, 431-4(1959) Mar.

The weak coupling unified model is applied to the low lying levels of Si^{29}. It is shown that, although the energy levels are predicted quite successfully by the model, it has only qualitative success in explaining other properties such as the magnetic moment or β-decay of P^{29}. (auth)

21504

COMMENT ON (p,n) CROSS SECTIONS. R. Nakasima (Osaka City Univ.) and H. Watanabe (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 21, 462-5(1959) Mar.

Recent measurements by Howe on excitation cross sections of Cu and Zn isotopes show large variations from isotope to isotope in the magnitude of the (p,n) cross section. Cross sections calculated from the compound nucleus model for the isotopes of Ni, Cu, and Zn are compared to experimental data. It is concluded that the large variations in the (p,n) reaction, as measured by Howe, are not evidence for the non-compound nuclear process but offer an example as to the usefulness of the compound nucleus picture in such an energy region. (C.J.G.)

21505

MOLECULAR PROCESSES INDUCED BY μ^- MESONS IN HYDROGEN BUBBLE CHAMBER. II. MECHANISMS OF FORMATION OF μ^- MESONIC HYDROGEN MOLECULAR ION. Yukio Mizuno, Takeo Izuyama, and Mikio Shimizu (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 479-80(1959) Mar.

A study of the mechanism of μ^--mesic molecular ion formation by the low energy collision of a mesonic proton or deuteron atom with a proton or deuteron bound in an ordinary hydrogen molecule in a bubble chamber is presented. (C.J.G.)

21506

RESPONSE OF CsI(Tl) TO p, d, AND α PARTICLES. R. A. Peck, Jr. and H. P. Eubank (Brown Univ., Providence) and J. Lowe (Univ. of Birmingham, Eng.). Rev. Sci. Instr. 30, 703-6(1959) Aug.

The relation of pulse height in CsI(Tl) to particle energy for protons, deuterons, and alpha particles was examined below 20 Mev under a variety of experimental conditions. Observed deviations from simple proportionality (both constant and quadratic terms in a power series representation) depend upon circuit parameters. For a given apparatus, the deviations vary monotonically with the energy interval represented by one spectrometer channel, and tend to zero in the limit of vanishing channel width. The observations suggest that the intrinsic response of CsI(Tl) in the limit of vanishing instrumental effects deviates from a straight line through the origin by less than 0.1% per Mev. Observed curvatures, for channel widths of order 0.3 to 0.6 Mev, are in the range 0.1 to 1%/Mev for both protons and deuterons. Pulse-height ratios for given energy are found to be $d:p = 1.04(+0.08, -0.02)$ and $\alpha:p = 0.50(\pm 0.03)$. Spectrometer peak positions are determined with a precision of 0.1 channel or better by a method of analytic interpolation. (auth)

21507

THE γ SPECTRUM OF RaC'(Po^{214}). C. Mayer-Böricke (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 14a, 609-27(1959) July. (In German)

A scintillation pair spectrometer, which is used for the spectroscopy of gamma radiation over 1.1 Mev, and which has a grey wedge analyzer and energy discrimination in the lateral branch, is described. The gamma transition of Po^{214} was investigated with this apparatus and the single lines were measured with respect to energy and intensity (Rn^{222} source). For evaluation of the grey wedge spectra a sensitive photometric method was used. Gamma lines with $E_\gamma > 1150$ kev, reported previously, were confirmed by the measurements. In addi-

tion a number of new very weak high energy gamma transitions were found. Altogether 40 lines over 1 Mev were observed. The conversion electron spectrum of Po^{214} was analyzed on the basis of the measured gamma radiation. An energy level diagram is given in which all known gamma rays are arranged. The spin and parity of individual levels were discussed. Some levels were interpreted as collective vibration states, that is, as single phonon and two phonon excitation of a quadrupole oscillation. (tr-auth)

21508

THE BRANCHING RATIO OF PRASEODYMIUM-142. E. Freiberg and K. Goebel (Universität, Freiburg i. B.). Z. Naturforsch. 14a, 679(1959) July. (In German)

The branching ratio a of both components of the beta radiation of Pr^{142} was remeasured using the β-γ coincidence method. The beta radiation was detected with an end-window counter, and the gamma radiation was detected with a scintillation counter. The Pr^{142} was prepared by the $Pr^{141}(n,\gamma)$ reaction. A value $\underline{a} = (3.7 \pm 0.4)\%$ was obtained. (J.S.R.)

21509

COMPTES RENDUS DU CONGRES INTERNATIONAL DE PHYSIQUE NUCLÉAIRE. INTERACTIONS NUCLÉAIRES AUX BASSES ENERGIES ET STRUCTURE DES NOYAUX, PARIS, 7-12 JUILIET, 1958. (Proceedings of the International Congress of Nuclear Physics. Nuclear Interactions at Low Energies and Nuclear Structure, Paris, 7-12 July, 1958.) Paris, Dunod, 1959. 968p.

21510

ELASTIC SCATTERING OF NEUTRONS. H. H. Barschall (Univ. of Wisconsin, Madison). p. 7-22 of "Proceedings of the International Congress of Nuclear Physics."

Neutron interactions with nuclei primarily insofar as they have a bearing on the optical model of the nucleus are discussed. Only interactions with medium and heavy nuclei are considered. (W.D.M.)

21511

ELASTIC SCATTERING OF PROTONS AND SOME OTHER CHARGED PARTICLES. A. E. Glassgold (Univ. of California, Berkeley). p. 23-37 of "Proceedings of the International Congress of Nuclear Physics."

A review is presented of some of the communications on optical model scattering. Elastic scattering of protons is considered. Other charged particles are briefly mentioned. (W.D.M.)

21512

ELASTIC SCATTERING OF ELECTRONS. R. Hofstadter (Stanford Univ., Calif.). p. 41-76 of "Proceedings of the International Congress of Nuclear Physics."

The elastic scattering of high energy (150 to 650 Mev.) electrons is considered. A rather general survey of the work at Stanford over the past 4 or 5 years is given. Scattering on both nucleons and nuclei is treated. The method of using electrons to investigate nuclear structure and its limitations is discussed. (W.D.M.)

21513

RECENT STUDIES OF DEUTERON STRIPPING REACTIONS. G. R. Satchler (Clarendon Lab., Oxford). p. 101-16 of "Proceedings of the International Congress of Nuclear Physics."

The simple theories of deuteron stripping and other direct reactions have had considerable successes in explaining the gross features of experimental angular distributions at medium energies. The basic assumption made is that the reaction can be described by first order perturbation theory. Various approaches to the stripping reaction and possible areas of research are pointed out. (W.D.M.)

21514

DIRECT INTERACTION–EXPERIMENTAL. L. Cohen (Oak Ridge National Lab., Tenn. and Univ. of Pittsburgh). p. 117-26 of "Proceedings of the International Congress of Nuclear Physics."

Experimental work on direct interactions is briefly summarized. Inelastic scattering of protons, neutrons, and deuterons by medium and heavy elements is considered. (W.D.M.)

21515

NUCLEAR REACTIONS INDUCED BY HEAVY IONS. A. Zucker (Oak Ridge National Lab., Tenn.). p. 129-41 of "Proceedings of the International Congress of Nuclear Physics."

The present state of development in heavy ion reactions is reviewed. Various topics are separately considered including scattering, fission, transfer reactions, Coulomb excitation, evaporation reactions, and transuranic element production. (W.D.M.)

21516

PHOTONUCLEAR REACTIONS. J. S. Levinger (Univ. of Birmingham, Eng.). p. 145-65 of "Proceedings of the International Congress of Nuclear Physics."

A review of 17 papers concerning various aspects of photonuclear reactions is presented. A summary of recent calculations of angular distributions in the deuteron photoeffect is given. The cross section for photon absorption is discussed for discrete levels and in the continuum region of the giant dipole resonance. The products reactions are discussed in terms of the statistical and direct emission models. Experimental data on photoneutrons, photoprotons, and photoalphas are considered. (W.D.M.)

21517

THE SHELL-MODEL AND THE WEAK-COUPLING VERSION OF THE COLLECTIVE MODEL. A. M. Lane (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p. 169-86 of "Proceedings of the International Congress of Nuclear Physics."

Nuclear models are discussed in terms of the independent particle model mainly, and to some extent, the way that collective motion has to be introduced into the individual particle model in order to present a better picture of the experimental results. Basic models of the nucleus are described and which nuclei are associated with which models are indicated. (W.D.M.)

21518

CONNECTION BETWEEN THE SHELL MODEL AND THE ROTATIONAL MODEL. S. A. Moszkowski (Univ. of California, Los Angeles). p. 187-99 of "Proceedings of the International Congress of Nuclear Physics."

The nucleus F^{19} provided the first clear-cut example of a case where both the shell and rotational models can account for the experimental results. In fact, the predictions of the two models agree even slightly better with each other than with experiment. Special cases are discussed where the two models are exactly equivalent. Some recent work which gives strong indications of a general near equivalence is mentioned. (W.D.M.)

21519

COLLECTIVE NUCLEAR MOTION. A. Bohr (Univ. of Copenhagen). p. 203-24 of "Proceedings of the International Congress of Nuclear Physics."

The main features of the low-energy collective nuclear excitation modes were recognized several years ago. The character of the spectrum depends above all on the nuclear equilibrium shape, which in turn is intimately related to the shell structure. Contributions to the conference on collective excitation spectra, rotational band structure, and related topics are summarized. (W.D.M.)

21520

COULOMB EXCITATION. F. K. McGowan (Oak Ridge National Lab., Tenn.). p. 225-39 of "Proceedings of the International Congress of Nuclear Physics."

The Coulomb excitation reaction has so far been used for the study of rather low-lying states, but with the use of higher bombarding energies it has been possible also to explore excitations of somewhat higher energy; namely, the second 2+ state in a number of medium-weight nuclei. Coulomb excitation of medium-weight even-even nuclei, Coulomb excitation of the second 2+ state in W, Os, Pt, and Th nuclei, and second-order effects in Coulomb excitation are discussed. (W.D.M.)

21521

THE STRUCTURE OF NUCLEAR MATTER. C. Bloch (Centre d'Etudes Nucléaires, Saclay, France). p. 243-68 of "Proceedings of the International Congress of Nuclear Physics." (In French)

A discussion is presented of the primary developments in the study of the structure of nuclear matter. The principal ideas discussed include the application of the perturbation theory to systems composed of a large number of particles, the Brueckner theory, numerical results and convergence, the variational method, attractive potentials in the vicinity of the Fermi surface, the formula of associated diagrams, propagation of a particle in nuclear matter, the Hugenholtz and Van Hove theorem, the finite nucleus, and the extension to statistical mechanics. 33 references. (J.S.R.)

21522

WEAK INTERACTIONS. THEORY AND RECENT EXPERIMENTAL DATA. R. Nataf (College de France Orsay). p. 271-316 of "Proceedings of the International Congress of Nuclear Physics." (In French)

The present theory of weak interactions is discussed with a consideration of the two-component neutrino, the Weyl representation of the Dirac equations, the law of β disintegration and the polarization maxima of β electrons, and the Feynman and Gell-Mann theory. The most recent experiments are briefly described and the results obtained on the law of β decay are indicated. These results include the asymmetries in β decay of polarized nuclei, asymmetries in β decay of other polarized nuclei and β-γ correlation for polarized nuclei, β-ν circularly polarized angular correlations, and angular correlations and related experiments. The important experiment of Goldhaber et al. on the helicity of the neutrino is reported. 19 references. (J.S.R.)

21523

CONCLUSIONS. L. Rosenfeld (Univ. of Manchester, Eng.). p. 319-32 of "Proceedings of the International Congress of Nuclear Physics."

The discussions for the entire week of the conference are summarized briefly. The general impression obtained by the author was that no spectacular discoveries were brought forth, neither were there any acute contradictions between experiments or between experiment and theory. (W.D.M.)

21524

EXCHANGE EFFECTS IN INELASTIC SCATTERING. M. K. Banerjee (Inst. of Nuclear Physics, Calcutta). p. 335-7 of "Proceedings of the International Congress of Nuclear Physics."

In the present calculation of the $C^{12}(p,p')C^{12}$ differential cross section it was noted that a range of 2.45 fermis and a well depth of 70 Mev produces the desired parameters. The relative importance of the matrix term, E_2, as a function of energy is pointed out. (W.D.M)

21525

SECOND ORDER EFFECTS IN COULOMB EXCITATION. G. Breit (Yale Univ., New Haven). p. 347-8 of "Proceedings of the International Congress of Nuclear Physics."

Second order effects in Coulomb excitation have been considered as a means of determining multipole matrix elements between nuclear energy levels. Most of the calculations of second order effects have been made in the semi-classical approximation for the relative motion of target and projectile. The validity of the approximation was examined in the special case of the excitation of the 2+ level of Pt^{196}. (W.D.M.)

21526

MEASUREMENT OF PROTON POLARIZATION IN THE REGION OF 10 Mev to 18 Mev. K. W. Brockman, Jr. (Univ. of Minnesota, Minneapolis). p.350-4 of "Proceedings of the International Congress of Nuclear Physics."

The use of proton-helium scattering as a polarization analyzer below 10 Mev has been known and applied in the past. New measurements of the differential scattering cross section for this interaction have made possible extension of the phase shift analyses to 18 Mev and beyond, and have allowed the calculation of polarization in this energy region. A polarization analyzer was built using the information obtained in these calculations. It has been used to (1) check the validity of the calculations, (2) set an upper limit on the polarization in p-p scattering at 30° (laboratory) at 17.7 Mev, and (3) to obtain angular distributions of the polarization in both elastic and inelastic (4.4 Mev excitation) scattering by carbon at 17.7 Mev. (auth)

21527

REACTION MECHANISM STUDIES ON THE $^{16}O(^3He, \alpha)^{15}O$ REACTION. D. A. Bromley, J. A. Kuehner, and E. Almqvist (Atomic Energy of Canada, Ltd., Chalk River, Ont.). p.355-62 of "Proceedings of the International Congress of Nuclear Physics."

By analogy with deuteron induced reactions it might be expected that (He^3,α) and (He^3,d) reactions should proceed primarily via direct interaction mechanisms even at low incident energies. Measurements by Holmgren on the $C^{13}(He^3,\alpha)C^{12}$ reaction at 2.0 and 4.5 Mev appear to confirm this expectation. In the $O^{16}(He^3,\alpha)O^{15}$ reaction, on the other hand, for incident energies in the vicinity of 2.4 Mev pronounced resonance behavior is observed. Excitation curves and angular distributions were fitted using standard resonance reaction compound system formalism including energy dependent shifts and corrections. Interfering $\frac{1}{2}$+ and $\frac{5}{2}$+ resonances corresponding to excitations of

10.44 and 10.46 Mev in Ne^{19} are required to fit the data; the resonance parameters were obtained. At energies above these resonances there is evidence from the alpha particle angular distribution which suggests that a direct interaction mechanism rapidly becomes competitive with compound system formation. (auth)

21528

THE SCATTERING OF ALPHA PARTICLES BY HELIUM. W. E. Burcham and J. S. McKee (Univ. of Birmingham, Eng.); W. M. Gibson (CERN, Geneva); D. Bredin (Univ. of Belfast); D. Evans and D. J. Prowse (Univ. of Bristol); and J. Rotblat (St. Bartholomew's Hospital, London). p.366-70 of "Proceedings of the International Congress of Nuclear Physics."

The scattering of alpha particles by helium was studied at 8 incident energies between 23 and 38.4 Mev. A phase shift analysis confirms the existence of a level of spin 4+ at an excitation energy of about 13 Mev in Be^8. (auth)

21529

EXCHANGE EFFECTS IN DEUTERON STRIPPING REACTIONS. B. Buck and G. R. Satchler (Clarendon Lab., Oxford). p.363-5 of "Proceedings of the International Congress of Nuclear Physics."

The $B^{10}(d,p)B^{11}$ (2.1) and $B^{10}(d,n)C^{11}$ (1.9) reactions were studied further using the model of A. P. French in which a nucleon in the deuteron is exchanged with one in the target. The additional approximation of treating the deuteron as a point particle greatly simplifies the calculations and shows how the exchange terms can give rise to the l = 1 type angular distribution observed, and the sign of proton polarization found for the (d, p) reaction. Some of the general properties of these exchange terms are discussed. (auth)

21530

THE LOW ENERGY SCATTERING OF NUCLEONS BY LIGHT NUCLEI. P. G. Burke (Univ. of London) and W. Laskar (University Coll., London). p.371-5 of "Proceedings of the International Congress of Nuclear Physics."

A theoretical investigation is being carried out of the elastic and inelastic scattering of nucleons by light nuclei. The method of Wheeler's resonating group structure is used all through the work and the interaction assumed is central with space and spin exchange dependence. The formalism was carried out for n-d elastic scattering and for d-d elastic and inelastic scattering into channels $n\text{-}He^3$ and $p\text{-}H^3$. For the n-d scattering, numerical calculations were completed and results compared with experiment. For this same problem the effect of polarization of the deuteron was investigated by a variational method. (auth)

21531

SPECTRA OF LOW ENERGY PROTONS. S. W. Chen, R. M. Eisberg, and N. M. Hintz (Univ. of Minnesota, Minneapolis). p.377-82 of "Proceedings of the International Congress of Nuclear Physics."

Careful measurements were made of the continuous spectra in the region of the Coulomb barrier cutoff. At large angles the spectra are independent of angle, indicating the protons come mainly from compound nucleus processes. If this is the case, then theory indicates that the ratio of the proton to the neutron spectra, emitted by the same elements, should essentially be equal to the Coulomb barrier penetration factor as a function of energy. This quantity should be very sensitive to the nuclear radius and surface thickness and help resolve ambiguities in determining the optical model parameters. Measurements of the neutron spectra are now being made. (auth)

21532

CONTINUOUS SPECTRA OF PROTONS. S. W. Chen and N. M. Hintz (Univ. of Minnesota, Minneapolis). p. 383-6 of "Proceedings of the International Congress of Nuclear Physics."

A general survey is underway to investigate the unresolvable and continuous parts of the spectrum of inelastic protons from various elements. Spectra taken at several angles for Pb^{208} and Cu^{63} are shown along with preliminary spectra on Cu^{65}, C^{12}, N^{14}, and Li. (W.D.M.)

21533

40 Mev INELASTIC SCATTERING. S. W. Chen and N. M. Hintz (Univ. of Minnesota, Minneapolis). p.387-91 of "Proceedings of the International Congress of Nuclear Physics."

The angular distribution of 40 Mev protons exciting the 2.19 Mev state of Li^6 and the 4.61 Mev state of Li^7 was measured from 15 to 145°. In addition the angular distribution of the first three states of C^{12} were obtained at the same proton energy. The results are discussed briefly in terms of a direct interaction model. (auth)

21534

NUCLEAR REACTION STUDIES WITH 23-Mev PROTONS. B. L. Cohen, A. G. Rubin, and C. B. Fulmer (Oak Ridge National Lab., Tenn.). p.392-4 of "Proceedings of the International Congress of Nuclear Physics."

Results are presented on [1] high energy resolution studies of direct interaction inelastic proton scattering, [2] a survey of (p,p′), (p,d), (p,t), and (p,α) reactions, and [3] a detailed study of (p,p′) reactions in medium weight elements as a function of bombarding energy. In [1] it is found that these reactions strongly excite collective levels, but only weakly excite single particle levels. In [2] it is found that (p,d) and (p,t) reactions, and (p,α) reactions in heavy elements are "pick-up" processes. (p,α) reactions in elements up to tin probably go largely by compound nucleus. Coulomb barriers are lower for alphas emitted from highly excited nuclei than for alphas bombarding ground state nuclei. (p,p′) reactions in heavy elements are principally direct interactions but only partly of the nucleon-nucleon collision type; there is probably a large amount of direct excitation of collective states. In [3] an experimental separation of first and second protons is possible up to 17-Mev bombarding energy; below 12 Mev, the reactions are wholly explainable as compound nucleus; above 12 Mev, direct interactions appear, increasing in importance with increasing bombarding energy. There is evidence that the incident particle is re-emitted with high probability; a possible explanation is given. (auth)

21535

THE SCATTERING OF ALPHA PARTICLES BY CARBON. J. B. England (Queen's Univ., Belfast) and J. S. C. McKee (Univ. of Birmingham, Eng.). p.402-5 of "Proceedings of the International Congress of Nuclear Physics."

Angular distributions for alpha-particles of 38.5 Mev energy scattered from carbon are presented. No theoretical analysis of these curves is undertaken. (auth)

21536

EVIDENCE FOR THE EXISTENCE OF ALPHA PARTICLES IN LIGHT NUCLEI. F. Gabbard, H. Bichsel, and T. W. Bonner (Rice Inst., Houston, Tex.). p.406-9 of "Proceedings of the International Congress of Nuclear Physics."

The cross section for the reactions $N^{14}(n,\alpha)B^{11}$ and $N^{14}(n,p)C^{14}$ were measured as a function of neutron energies. Fourteen resonances are observed for neutron energies of from 1.8 through 4.2 Mev and in the case of thirteen of these the cross section for α-emission is larger than that for proton emission. States in the N^{15} compound nucleus at 12.52, 13.13, and 13.18 Mev decay by α-emission with a probability at least 30 times greater than by proton emission. Since there are no selection rules to prohibit proton emission, it is suggested that the unexpectedly large cross section for α-emission is due to the existence of α-particles in the compound nucleus N^{15}. Further evidence for this conclusion comes from the large cross sections for triton emission from the reaction $N^{14}(n,t)C^{12}$ which was observed for neutron energies of 7 to 8.2 Mev. (auth)

21537

INELASTIC SCATTERING OF 14-Mev NEUTRONS IN THE ELEMENTS C, Fe, AND Bi BY THE TIME-OF-FLIGHT METHOD. J. Garg and B. Torki (College de France, Paris). p. 410-14 of "Proceedings of the International Congress of Nuclear Physics." (In French)

The neutron spectra emitted during the inelastic scattering of 14-Mev neutrons in the elements C, Fe, and Bi were measured by the time-of-flight method. Each spectrum shows discrete groups at low energies and an important probability for the emission of high energy neutrons. Moreover, the energy distribution of the neutrons emitted toward the lower energies is not Maxwellian as is predicted by the statistical theory. The probability for the emission of high-energy neutrons can not be explained according to the model of strong interaction causing compound nuclei. Therefore, the results have led to the conclusion that for 14-Mev neutrons at least a part of the nucleon-nucleus interaction is made by the agency of a single nucleon of the target nucleus. (tr-auth)

21538

THE POLARIZATION OF DEUTERONS. L. J. B. Goldfarb. p.415-19 of "Proceedings of the International Congress of Nuclear Physics."

The elastic scattering of deuterons by He^4 at 1.069 Mev provides a source of highly polarized deuterons, or, alternatively, serves as an efficient analyzer of deuteron polarization. In general, the polarization of deuterons is described by tensors of the first and second rank; however, in this process the former tensors vanish while the tensors of second rank are independent of the nuclear matrix element and attain large values for various scattering angles. A calculation is made of the polarization of deuterons, elastically scattered by spinless nuclei, where the interaction is described in a phenomenological fashion by a central force, a spin-orbit force, and a tensor term. Using the He^4-scattering process as an analyzer, a left-right asymmetry is predicted for tensor forces but not for spin-orbit forces. (auth)

21539

THE INELASTIC SCATTERING OF 9.8 Mev PROTONS BY MEDIUM WEIGHT NUCLEI. G. W. Greenlees, J. Lowe, A. B. Robbins, and P. M. Rolph (Univ. of Birmingham, Eng.). p.424-31 of "Proceedings of the International Congress of Nuclear Physics."

Recent experiments on the inelastic scattering of protons by nuclei of medium Z have shown some unexpected effects, in particular, a pronounced increase in cross section at excitations of 2 to 3 Mev in all elements with Z between 40 and 52. A search for this "anomalous scattering" was made in Sn, In, Cd, Ag, Pd, Mo, Nb, Zn, Cu, and Ni, using 9.8 Mev protons. The prominent effect at excitations of 2 to 3 Mev was not found at 9.8 Mev. In Cu, Zn, and Ni an intense group corresponding to excitations of 1 to 1.4 Mev was observed. (auth)

21540

THE ELASTIC AND INELASTIC SCATTERING OF PROTONS BY SILICON. G. W. Greenlees, L. G. Kuo, J. Lowe, and M. Petravić (Univ. of Birmingham, Eng.). p.432-7 of "Proceedings of the International Congress on Nuclear Physics."

Absolute differential cross sections are given for the elastic scattering by silicon of 9.45, 9.28, 8.96, 8.55, and 7.97 Mev protons for an angular range of 15 to 156°. The angular distributions show characteristic maxima and minima, the patterns varying slowly with energy as might be expected for scattering by a complex potential. Absolute differential cross sections for the inelastic scattering of protons at these five energies from the 1.78 Mev level of Si^{28} are also given. All the inelastic angular distributions are asymmetric about 90° with a forward peaking. The magnitude of the asymmetry varies with energy and is greatest at 8.96 Mev. (auth)

21541

THE ELASTIC SCATTERING OF PROTONS BY CARBON, ALUMINIUM, NICKEL, COPPER, ZINC, NIOBIUM, SILVER AND GOLD. G. W. Greenlees, L. G. Kuo, and M. Petravić (Univ. of Birmingham, Eng.). p.438-46 of "Proceedings of the International Congress on Nuclear Physics."

Absolute differential cross-sections were measured at 10° intervals for the elastic scattering of protons of energy 9.37 ± 0.07 Mev from eight elements: C, Al, Ni, Cu, Zn, Nb, Ag, and Au. In addition, measurements were made for Al at 9.06, 8.86, 8.61, and 8.11 Mev. The scattering chamber permitted observations to be made in the angular range 15 to 165° and the scattered protons were detected using a CsI(Tl) crystal and photomultiplier arrangement with an energy resolution of 3%. The estimated error of each differential cross section given is ±3%. The angular distributions show characteristic maxima and minima and vary smoothly with target mass number and energy. (auth)

21542

DIRECT RADIATIVE CAPTURE REACTIONS. G. M. Griffiths (Univ. of British Columbia, Vancouver, Can.). p.447-50 of "Proceedings of the International Congress on Nuclear Physics."

Four reactions are considered in which protons or alpha particles are captured with no apparent compound nucleus formation, the reaction taking place from the continuum directly to the ground or excited state of the final nucleus and the energy difference being released by gamma ray emission. The absolute cross sections, the excitation functions, and angular distributions of the gamma rays were studied for $D(p,\gamma)He^3$, $O^{16}(p,\gamma)F^{17}$, $Li^6(p,\gamma)Be^7$, and $T(\alpha,\gamma)Li^7$. A brief discussion of theoretical results for the $D(p,\gamma)He^3$ and the $O^{16}(p,\gamma)F^{17}$ reactions is included. (auth)

21543

ANGULAR CORRELATION BETWEEN PAIRS OF PROTONS EMITTED IN A NUCLEAR REACTION. R. J. Griffiths and R. M. Eisberg (Univ. of Minnesota, Minneapolis). p.451-3 of "Proceedings of the International Congress on Nuclear Physics."

Measurements were made of the angular correlation between two fast protons emitted from Cu when bombarded by 40-Mev protons. The angular correlation is strongly peaked at 90° which gives conclusive evidence for the existence of the nucleon-nucleon scattering direct interaction process. (auth)

21544

MEASUREMENTS ON CIRCULARLY POLARIZED γ-RAYS FROM THE REACTION $^{55}Mn(n,\gamma)^{56}Mn$ WITH POLARIZED NEUTRONS. B. Grimeland (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). p.454-9 of "Proceedings of the International Congress of Nuclear Physics."

The circular polarization of γ-rays emitted from Mn^{56} after absorption of polarized neutrons in Mn^{55} was examined. The γ-rays were passed through an analyzing magnet and the transmission measured for both directions of the magnetic field. The results obtained indicate that the spin of Mn^{56} in the ground state has the value one. (auth)

21545

INELASTIC SCATTERING OF HIGH ENERGY PROTONS BY HELIUM. P. Hillman, A. Johansson, G. Tibell, and H. Tyrén (Univ. of Upsala). p.465-9 of "Proceedings of the International Congress on Nuclear Physics."

The energy spectra and polarizations of 185 Mev protons inelastically scattered at angles between 6.5 and 43.5° by helium were measured. A 90° magnetic analyzer and a cryostatic target were used. The spectra behave at smaller angles as might be expected on a simple picture of quasi-elastic scattering by single nucleons in the helium nucleus. However, a small peak persists near the proton and neutron separation energies even at larger angles. The polarizations measured for the inelastically scattered protons are, within rather large errors, consistent with free nucleon-nucleon scattering. (auth)

21546

THE POLARIZATION OF PROTONS FROM $^{12}C(d,p)^{13}C$ REACTION IN FUNCTION OF ANGLES. M. K. Jurić and S. D. Ćirilov (Inst. of Nuclear Sciences "Boris Kidrich," Belgrade). p.473-4 of "Proceedings of the International Congress on Nuclear Physics."

The polarization of the ground state proton group from stripping of 1-Mev deuterons in carbon was measured at five angles, using the elastic scattering of protons by carbon as the analyzing reaction. The magnitude of the polarization varied with angles, having the greatest value at 20° of about 44%. The sign of the polarization was found to be positive, which is in agreement with earlier experimentally obtained results. Positive sign of the polarization corresponds to the direction of the vector product $K_p \times K_d$. (auth)

21547

INELASTIC SCATTERING OF 20 Mev α-PARTICLES BY SEPARATED COPPER ISOTOPES. N. O. Lassen and N. O. Roy Poulsen (Inst. for Theoretical Physics, Copenhagen). p.477-83 of "Proceedings of the International Congress on Nuclear Physics."

Direct processes and compound scattering have been observed. The level density of the residual nucleus as a function of the excitation energy E*, determined from the shape of the α-energy spectrum, can in the energy region 4 to 10 Mev be written $\rho(E^*) = \text{const.} \times \exp(E^*/T)$, where T is a constant, which for a primary energy $E_0 = 20$ Mev is found to be 1.10 ± 0.03 Mev. Log $\rho \sim E^*$ gives a better fit to the experiments than log $\rho \sim \sqrt{E^*}$. The cross-sections for compound α scattering are in satisfactory agreement with the values calculated by means of the statistical theory using the above mentioned level density function. Studies were also made with lower primary α energies. Again the mentioned level density function is found, but with lower T values. Calculated and experimental cross sections vary in the same way with E_0. The anisotropy of the evaporated α particles is found to decrease with decreasing E_0, i.e., with increasing maximum angular momentum of the compound nucleus. (auth)

21548

TRITON INDUCED NUCLEAR REACTIONS. W. T. Leland (Los Alamos Scientific Lab., N. Mex.). p.484-95 of "Proceedings of the International Congress on Nuclear Physics."

The use of accelerated tritons has added an important member to the list of projectiles used in nuclear physics studies. The low binding energy and other properties of tritons make possible the study of new nuclei and ranges of nuclear excitation hitherto inaccessible to low energy accelerators. Tritons, being a three-nucleon system, are in themselves of interest in connection with many-body interactions. Experimental results of the reaction of tritons with tritons is presented along with an interpretation of the results in terms of a reaction proceeding in two stages. The possible influence of neutron-neutron forces is also discussed. Experimental results from a few selected experiments are also presented to illustrate the virtues of tritons as a nuclear physics projectile. (auth)

21549

THE MEASUREMENT OF NEUTRON RESONANCE SPINS AND POTENTIAL SCATTERING CROSS SECTIONS. J. E. Lynn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.496-500 of "Proceedings of the International Congress on Nuclear Physics."

The area method of neutron resonance analysis has been extended to include the effect of interference between potential and resonance scattering in the cross section. It is shown how this method enables one to determine the peak cross section and width of the resonance from neutron transmission measurements provided the potential scattering length is known. In the case of almost pure elastic scattering resonances, the use of the method on a few resonances enables the appropriate potential scattering lengths to be found. Hence, one may find the spins of the resonances and their weidths. The method is applied to the first two resonances of bismuth with the result that J = 5 for the 0.784 kev resonance, J = 4 for the 2.23 and 12 kev resonances. The potential scattering cross section is 10.3 ± 0.3 barn. (auth)

21550

THE SCATTERING OF ALPHA PARTICLES BY NEON. J. S. C. McKee and P. C. Rowe (Univ. of Birmingham, Eng.). p.501-5 of "Proceedings of the International Congress on Nuclear Physics."

The scattering of alpha particles by neon was studied at an energy of 31.8 Mev. Angular distributions are presented which show typical spherical Bessel function oscillations in the angular dependence of the differential cross section for inelastic scattering. In the case of the elastic scattering process, an approximate value is obtained for the radius of the interaction, using the diffraction formula for a strongly absorbing disc. (auth)

21551

EXCHANGE EFFECTS IN STRIPPING REACTIONS. M. A. Nagarajan and M. K. Banerjee (Inst. of Nuclear Physics, Calcutta). p. 506-10 of "Proceedings of the International Congress on Nuclear Physics."

Exchange effects in stripping reactions have been considered previously. The treatment is generalized to include targets containing several neuleons outside the closed shell. The calculations of the angular distributions were made by describing the nucleus by pure jj coupling wave functions. The reactions $F^{19}(d,p)F^{20}$, $Be^{9}(d,p)Be^{10}$, $Be^{10}(\alpha,N)C^{12}$, and $O^{18}(d,p)O^{17}$ were chosen to illustrate all the salient features of the phenomena. (W.D.M.)

21552

DOES THE BUCKSHOT TYPE PROCESS EXIST? R. Nakasima (Osaka City Univ.). p.511-14 of "Proceedings of the International Congress on Nuclear Physics."

In order to discuss the mechanism of the nuclear reaction induced by heavy ions, the reactions $Na^{23}(N^{14},\alpha p)P^{32}$ and $Na^{23}(N^{14},\alpha 2p)Si^{31}$ are analyzed by means of the compound nucleus model. Without the introduction of a new reaction mechanism, the experimental excitation cross sections seem to be explainable by the compound nucleus model with some extra modifications. (auth)

21553

ENERGY LEVELS IN NICKEL ISOTOPES (A = 58 THROUGH 62). C. H. Paris and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). p.515-18 of "Proceedings of the International Congress on Nuclear Physics."

The even nickel isotopes Ni^{58}, Ni^{60}, and Ni^{62} were bombbombarded with 7.0 Mev protons and deuterons. The charged reaction products were analyzed by the M.I.T. broad-range spectrograph. The excited states of the nickel isotopes A = 58 through 62 were observed up to 4.0 Mev excitation. (auth)

21554

POLARIZATION OF d-D NEUTRONS. P. J. Pasma (Rijks-Universiteit, Groningen, Netherlands). p.519-21 of "Proceedings of the International Congress on Nuclear Physics."

The polarization of neutrons from the $D(d,n)He^3$ reaction was determined from the left-right asymmetry induced when the neutrons are scattered elastically by He^4 nuclei. The experimental setup is described and results are given for deuteron energies between 200 and 500 kev. (W.D.M.)

21555

MEASUREMENT OF SPIN POLARIZATION BY NUCLEAR SCATTERING. G. C. Phillips and P. D. Miller (Rice Inst., Houston, Tex.). p.522-6 of "Proceedings of the International Congress on Nuclear Physics."

Accurate measurements of differential cross sections for elastic scattering of protons from He^4, C^{12}, and O^{16} and of He^3 from He^4 in the energy range 2 to 6 Mev were phase shift analyzed and the expected spin polarization of scattered particles calculated. The results, plotted as contours of equal spin polarization versus energy and angle, should be useful in accurate measurements of spin polarization and in addition show a number of rather striking complexities due to interference effects. (auth)

21556

THE ENERGY SPECTRUM OF NEUTRONS EMITTED DURING THE (n,2n) REACTION. E. Remy and K. Winter (College de France, Paris). p.527-31 of "Proceedings of the International Congress on Nuclear Physics." (In French)

A study of the principal mechanism of the (n,2n) reaction was made by the measurement of the energy spectrum. In Mn^{55}, I^{127}, and Ta^{181} the mechanism of the successive emission of two neutrons in the (n,2n) reaction is predominant. These results indicate the existence of a compound nucleus between the emission of the first and second neutron. (tr-auth)

21557

NUCLEAR SHAPE EFFECTS IN DEUTERON STRIPPING. J. Sawicki (Princeton Univ., N. J.) and G. R. Satchler (Clarendon Lab., Oxford). p.534-5 of the "Proceedings of the International Congress on Nuclear Physics."

The effect on surface reactions, such as deuteron stripping of the non-spherical surface, of deformed nuclei and the fluctuations in shape of nuclei which exhibit collective vibrations were studied. These allow, for example, contributions to a peak in the angular distribution with a characteristic L value different from the orbital momentum l of the captured nucleon. While these effects are mostly small, they have to be considered when experimental reduced widths are compared with a nuclear model. (auth)

21558

NOTE ON THE SCATTERING OF FAST NEUTRONS BY ^{20}Ne. C. P. Sikkema (Rijksuniversiteit, Groningen, Netherlands). p.541-4 of "Proceedings of the International Congress on Nuclear Physics."

A few results about the scattering of fast neutrons by Ne^{20} in the energy range 1.9 to 3.5 Mev are given in addition to results reported in an earlier paper on this subject. The total cross section reported previously is corrected for the contribution of Ne^{22} to the measurements with the natural isotope mixture. Re-measured and corrected angular distributions for elastic scattering for neutron energies between 1.89 and 2.05 Mev are presented. A careful analysis of the resonance at 1.94 Mev confirms the assignment $D_{\frac{5}{2}}$ reported in the previous paper. (auth)

21559

ELASTIC SCATTERING OF 3.2 Mev POLARIZED NEUTRONS. M. F. Steuer, W. P. Bucher, and F. L. Hereford (Univ. of Virginia, Charlottesville). p.545-6 of "Proceedings of the International Congress on Nuclear Physics."

Partially polarized D-D neutrons were used to study the elastic scattering polarization produced by a number of elements. The polarization of the D-D neutrons employed was established with better accuracy through measurement of the $C^{12}(n,n)$ right-left asymmetry by means of a coincidence technique, and through consideration of this result in the light of recently determined $C^{12}(n,n)$ phase shift. (auth)

21560

GROUP STRUCTURE IN INELASTIC SCATTERING OF 30 Mev α-PARTICLES. D. R. Sweetman and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). p.547-51 of "Proceedings of the International Congress on Nuclear Physics."

Motivated by the recent interest in gross structure properties of nuclei and nuclear reactions, inelastic α-particle scattering was examined. Structure which persists from element to element was found. This structure is excited via a direct interaction as determined by a study of the angular distributions of the group structure, which show a pronounced forward peaking. Several angular distributions as well as the energy spectra resulting from this excitation are given. (auth)

21561

INELASTIC SCATTERING OF PROTONS BY VARIOUS NUCLEI. T. Tamura and D. C. Choudhury (Univ. of California, Los Angeles). p.552-6 of "Proceedings of the International Congress on Nuclear Physics."

Experiments performed by Cohen and others are analyzed theoretically, by using the direct interaction theory. The most detailed calculation is done for lead isotopes and the agreement with experiment is surprisingly good, showing that this simple theory explains not only the angular distribution but also the relative excitation of different states. The high peaks which appear at $-Q \simeq 2.5$ Mev seem to be due to a particular single particle transition. As for the anomalous peaks for nuclei with Z = 30-53, several arguments can be given which might support the view that these peaks are associated with the excitation of the octupole surface vibrations. (auth)

21562

STUDY AT 14 MEV OF THE ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED BY ALUMINUM, COBALT, AND TANTALUM. B. Torki (College de France, Paris). p.557-9 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The angular distribution of neutrons scattered by aluminum, cobalt, and tantalum was studied to determine if there is a compound nucleus or a direct interaction at 14 Mev. A beam of 14-Mev neutrons, defined by an n-coincidence of the T(d,n)He^4 reaction, falls on a cylindrical target. The spectrum of scattered neutrons is obtained by the time-of-flight method. Each spectrum is divided into three parts: from 1 to 2 Mev, from 2 to 4 Mev, and from 4 to 10 Mev. The results show that between 1 and 2 Mev there is symmetry with reference to 90°. This symmetry disappears more and more when the emission energy increases and it is then probable that there is a predominance of direct interaction. (tr-auth)

21563

PROTON WIDTHS AND RADIATIVE WIDTHS. C. van der Leun (Rijksuniversiteit, Utrecht.). p.560 of "Proceedings of the International Congress on Nuclear Physics."

A survey was made of the yield measurements of (p,γ) reactions on nuclei with mass numbers between 22 and 35. The yield of a (p,γ) reaction is proportional to $\Gamma_p \Gamma_\gamma / (\Gamma_p + \Gamma_\gamma)$, where Γ_p and Γ_γ are the proton and radiative widths. In a great number of cases, it is impossible to decide whether Γ_p or Γ_γ limits the resonance strength. (W.D.M.)

21564

ANGULAR CORRELATION OF NEUTRONS EMITTED DURING THE Be^9 (n,2n)Be^8 REACTION. K. Winter, B. Torki, and E. Remy (College de France, Paris). p.561-4 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The angular correlation of particles emitted in three-particle reactions give supplementary information on the reaction mechanism. A beam of 14-Mev neutrons impinge on a beryllium target. The two neutrons emitted during the Be^9(n,2n)Be^8 reactions are detected in coincidence in a plane perpendicular to the incident beam. The number of coincidences was measured by varying the angle of the two counters. The experiment was repeated with a carbon target to determine the effects of neutron diffusion from one counter to the other. A correlation with a maximum value of (20 ± 3)% at 60° (in the laboratory system) was found. (tr-auth)

21565

A STUDY OF CHARGED PARTICLE REACTIONS INVOLVING LIGHT NUCLEI. J. E. Young, J. E. Brolley, Jr., and L. Rosen (Los Alamos Scientific Lab., N. Mex.). p.565-70 of "Proceedings of the International Congress on Nuclear Physics."

Experimental studies of a systematic nature have been made, and are continuing, on interactions of nuclear systems containing a total number of up to five nucleons. Cross sections were measured for elastic and inelastic scattering p-T, p-He^3 at 6 to 8 Mev; d-t, d-He^3 elastic, inelastic, and total inelastic; p-He^4 elastic at 6 to 8 Mev; and d-D elastic and inelastic at 6 to 14 Mev. (W.D.M.)

21566

DIFFERENTIAL CROSS SECTION MEASUREMENTS OF LARGE ANGLE ELASTIC SCATTERING OF 14 Mev NEUTRONS OF ALUMINUM, IRON, LEAD AND BISMUTH. K. Yuasa (Konan Univ., Kobe, Japan). p.571-6 of "Proceedings of the International Congress on Nuclear Physics."

The absolute differential cross sections for the elastic scattering of 14 Mev neutrons from aluminum, iron, lead, and bismuth were measured. The neutrons were counted in coincidence with the alpha particles from the reactions. The background counting rate due to the accidental coincidences between the alpha particles and the neutrons which come directly to the detector from the target were reduced by counting the alpha particles corresponding to these neutrons and then using them to cancel the accidental coincidences. The measurements were taken over an angular range of 70 to 170° in 10-degree steps. The present measurements are in good agreement with exact phase shift analysis by Bjork-lund and Fernbach including spin-orbit term. (auth)

21567

NUCLEAR REACTIONS AND SCATTERING WITH 28-Mev N^{3+} IONS. A. Zucker (Oak Ridge National Lab., Tenn.). p.577-8 of "Proceedings of the International Congress on Nuclear Physics."

Nuclear reactions produced by 28-Mev nitrogen ions in elements ranging from lithium to potassium were studied. Energy spectra of light particles from such reactions show agreement with a statistical decay of the compound nucleus. Angular distributions are largely isotropic, with the exception of α-particles from oxygen targets which are emitted preferentially in the forward

direction. The elastic scattering of nitrogen from beryllium was measured from 50 to 100° in the barycentric system. (auth)

21568

THE POSSIBILITY OF DETECTION OF THE DINEUTRON. A. I. Baz and Ya. A. Smorodinskii (I. A. Smorodinsky) (Inst. of Atomic Energy, USSR). p.579-81 of "Proceedings of the International Congress on Nuclear Physics." (In French)

An original method for the detection of the dineutron is proposed. It consists in the study of the dependence of the neutron scattering cross section, in the d(n,n)d reaction, on the energy in the vicinity of the region where the formation threshold for the dineutron should be found. If it exists, one will observe for the point which corresponds to the dineutron formation, very specific peculiarities (a very rapid rise or a fall) in the dependence of the cross section on the energy. If the dineutron does not exist, the variation of the cross section will be a regular function of the neutron energy without any irregularities. Estimations show that the length of the region of irregularities is approximately from 10 to 50 kev and its height is 2 to 7% of the value of the scattering cross section found for the point corresponding to the threshold. (tr-auth)

21569

THE RATIO OF THE PRODUCTION RATES OF THE ISOMERIC STATE AND THE GROUND STATE OF Zn^{69} FOR VARIOUS NUCLEAR REACTIONS. K. I. Zherebtsova (Gerebtsova), T. P. Makarova, Yu. (Iu.) A. Nemilov, and B. L. Funstein (Founchtein) (Academy of Sciences, USSR, Leningrad). p.583-6 of "Proceedings of the International Congress on Nuclear Physics." (In French)

This paper was previously abstracted from Zhur. Eksptl'. i Teoret Fiz. 35, 1355-7(1958) Dec. and appears in NSA, Vol. 13, as abstract No. 5069.

21570

OPTICAL MODEL FOR THE INTERACTION OF NEUTRONS WITH AVERAGE ENERGY WITH NUCLEI. A. V. Lukyanov (Loukjanov), Yu. (Iu.) V. Orlov, A. N. Tikhonov, V. V. Turovtsev (Tourovtsev), and I. S. Shapiro (Chapiro) (Academy of Sciences, USSR, Moscow). p.587-97 of "Proceedings of the International Congress on Nuclear Physics." (In French)

A simple function of the rounded edge potential, satisfying the condition of continuity, and describing the optical model of neutron-nuclei interaction, is studied. To describe the diffuse region of the potential, a polynomial of the third degree is used. The equation for the radial part of the wave function in one region of the potential well can only be solved numerically, but in the other regions it is solved by direct integration. The method used in the choice of parameters is described. The theoretical results of the cross sections are compared with experimental results for Cr, Al, S, Fe, Cu, In, Sn, Ta, Pb, Bi, Mg, Ca, and Cd. The agreement is good. (J.S.R.)

21571

NUCLEON SCATTERING CROSS SECTION AND THE OPTICAL MODEL OF THE NUCLEUS. M. V. Pasechnik (Passetchnik), N. N. Pucherov (Poutcherov), and I. A. Tot'skii (Totsky) (Academy of Sciences, USSR, Moscow). p.598-602 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The angular distribution of 6.8-Mev protons and 2.8-Mev neutrons on a number of nuclei was studied. The results obtained were interpreted on the basis of the optical model of the nucleus and the parameters of the model were determined. An attempt was made to compare, in the framework of the optical model, the angular distribution of neutrons elastically scattered by Cu with the angular distribution of proton scattering. (tr-auth)

21572

ELASTIC SCATTERING OF LOW ENERGY DEUTERONS. I. Slaus and W. P. Alford (Univ. of Rochester, N. Y.). p.603-6 of "Proceedings of the International Congress on Nuclear Physics."

Angular distributions of deuterons elastically scattered from Mg, Al, Ti, V, Cr, Co, Ni, Cu, and Au were measured at 3.32 and 4.07 Mev. The relative cross-sections, $d\sigma/d\sigma$ (Rutherford), exhibit a smooth decrease from unity for angles greater than some critical angle which decreases regularly with increasing deuteron energy and decreasing atomic number. The similarity of the different cross-sections suggests that some gross-feature model should be able to explain these results. (auth)

21573

ON THE NUCLEAR LEVEL DENSITY IN CASE OF AN ENERGY GAP. V. Strutinsky (Univ. of Copenhagen). p.617-22 of "Proceedings of the International Congress on Nuclear Physics."

Some properties of the level density connected with the existence of an energy gap in the intrinsic excitation spectrum of nuclei are studied. Special attention is paid to the small energy region where the nuclear temperature, T, is smaller than energy gap value, 2δ. Due to a number of simplifications (classical statistics, simplified dispersion for elementary excitations) a simple expression is obtained which can be applied in the small energy region where only a few "excitations" are excited. The expression obtained shows a step-like dependence of the level density on the energy due to the discreteness of the number of excited pairs of "excitations" in the presence of the energy gap. A simple physical interpretation of the results is given; it is shown, in particular, that the nuclear temperature represents the average excess of energy per excitation over the energy, δ. With reasonable chosen parameters, the level density dependence on the energy is rather close to exponential, $\rho \sim \rho_0 \exp(-E_{exc}/T)$ with T of order of δ, in the energy region $5\delta \lesssim U \lesssim 20\delta$. The observed difference in the level densities of odd-even and even-even nuclei can be easily explained as a result of the presence of an odd particle without energy gap in an odd-even nucleus. The average value of the square of the the nuclear angular momentum projection is also calculated and the effect of the energy gap is discussed. (auth)

21574

ENERGY SPECTRA OF PHOTONEUTRONS AT 90°. A. Agodi, S. Cavallaro, G. Cortini, V. Emma, C. Milone, R. Rinzivillo, and A. Rubbino (Università, Catania, Italy and Centro Siciliano di Fisica Nucleare, Catania, Italy) and F. Ferrero (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). p.625-9 of "Proceedings of the International Congress on Nuclear Physics."

A short review is made of recent work by the authors about the energy spectra of the photoneutrons emitted at 90° with respect to the incident gamma ray direction.

New results on calcium and rhodium are given and compared with simple shell model calculations. The Ca spectrum shows an unusually high direct emission contribution. (auth)

21575

MEASUREMENTS OF THE ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTOPROTONS. W. C. Barber, W. R. Dodge, and V. J. Vanhuyse (Stanford Univ., Calif.). p.630-3 of "Proceedings of the International Congress on Nuclear Physics."

A magnetic spectrometer was used in connection with the Stanford 40-Mev linear electron accelerator to study the energy and angular distributions as well as the excitation functions of photoprotons from targets of C, Al, In, and Ta. In general the results indicate enough structure in the energy distribution that they cannot be explained by a single resonance modified by barrier effects. For C an analysis of the proton distributions leads to a cross section very similar to the $C^{12}(\gamma,n)$ cross section curve, as is expected from charge symmetry of nuclear forces. For In and Ta the Coulomb effects are very important, and the excitation functions prove that the protons are produced by photons of higher energy than those which produce photoneutrons. The high energy and large numbers of photoprotons from these elements indicate that they are produced in a "direct" process. (auth)

21576

PHOTOPROTONS FROM SILICON, PHOSPHORUS AND SULFUR. B. Čujec-Ďobovišek (Institut Josef Stefan, Ljubljana, Yugoslavia). p.634-40 of "Proceedings of the International Congress on Nuclear Physics."

The energy and angular distributions of photoprotons from silicon, phosphorus, and sulfur irradiated with 32 Mev bremsstrahlung were measured and compared with predictions of compound nucleus model and Wilkinson's shell model. The energy distributions were found to agree very well with predictions of Wilkinson's theory, whereas for angular distributions this model — neglecting all interferences — seems to be too simple. (auth)

21577

THE NUCLEAR PHOTOEFFECT AND NUCLEAR DEFORMATIONS. E. G. Fuller (National Bureau of Standards, Washington, D. C.). p.642-5 of "Proceedings of the International Congress on Nuclear Physics."

The correlation of the shape of the giant resonance for photon absorption with the ground state nuclear deformation as predicted by Okamoto and Danos was studied by a "poor energy resolution" survey of the shape of the neutron production cross section for nuclei ranging from tin through the rare earths to lead and by a "good energy resolution" determination of the shape of this cross section for terbium, tantalum, and gold. After correction for the neutron multiplicity above the $(\gamma,2n)$ threshold the data indicate a considerable broadening of the giant resonance for the highly deformed nuclei. The "good energy resolution" data show a splitting of the giant resonance for the deformed nuclei terbium and tantalum into two peaks while only one such peak is observed for gold. These data can be well fitted by the superposition of two Lorentz lines. The intrinsic quadrupole moments determined from these fits were: Tb: $+ 5.6 \pm 0.6$ barns, Ta: $+ 5.7 \pm 0.3$ barns, and Au: $+ 1.6 \pm 0.6$ barns. Preliminary measurements of the elastic scattering cross section for tantalum also show the splitting of the total absorption cross section into two peaks. (auth)

21578

PHOTON SCATTERING AND SELF ABSORPTION IN LEAD AND BISMUTH AT 7 Mev. E. G. Fuller and E. Hayward (National Bureau of Standards, Washington, D. C.). p.646-8 of "Proceedings of the International Congress on Nuclear Physics."

Elastic scattering cross sections for Pb, Pb^{206}, and Bi were measured in the energy range from 4 to 10 Mev. Self-absorption measurements were made at photon energies below the (γ,n) thresholds. These measurements, made both at room temperature and at liquid nitrogen temperature, indicate that the levels responsible for the scattering in Pb^{206} have widths between 0.2 and 3.0 ev while those in Pb and Bi must be greater than 3.0 ev wide. Evidence was also obtained that a large fraction of the scattering by Bi is produced by a single strong level which overlaps a similar level in Pb^{208}. (auth)

21579

RESONANT ABSORPTION OF GAMMA RAYS IN ^{14}N AND ^{11}B. S. S. Hanna and L. Meyer-Schützmeister (Argonne National Lab., Lemont, Ill.). p.650-2 of "Proceedings of the International Congress on Nuclear Physics."

A technique is described in which the resonant absorption is observed by direct measurement of the transmission through an absorbing sample. Measurements of the resonant absorption into the 9.19-Mev level of B^{11} and the 9.16-Mev level of N^{14} are reported. In both experiments the source of radiation was the reaction $C^{13}(p,\gamma)N^{14}$, $E_p = 1.76$ Mev. (W.D.M.)

21580

RESONANT ABSORPTION OF THE GAMMA RADIATION PRODUCED IN (p,γ) REACTIONS. P. B. Smith (Rijksuniversiteit, Utrecht). p.655-9 of "Proceedings of the International Congress on Nuclear Physics."

It is shown that it is feasible to observe nuclear resonant absorption of gamma radiation emitted in (p,γ) reactions. The technique offers the possibility of measuring the radiation width of levels to which the method is applicable, and measuring the total width of such levels with a resolution unattainable at present by other methods. The results of measurements on five levels are presented. The striking scarcity of intense ground-state transitions to which the method is applicable leads one to suspect that the few levels measurable below $E_p = 850$ kev are not characteristic of highly excited nuclear states. The accurate measurement of one level of a given nucleus serves, however, to calibrate the target scintillation counter, current integrator, and source geometry, so that ordinary yield measurements on other levels can be made to give results of the same precision. This technique could, in principle, be extended to the use of targets consisting of chemical compounds, so that all the level strengths of several elements could be determined to high precision, starting with the information obtained from one resonant absorption measurement. (auth)

21581

YIELDS OF PHOTO-ALPHA PARTICLES. M. E. Toms and J. McElhinney (Naval Research Lab., Washington, D. C.). p.660-4 of "Proceedings of the International Congress on Nuclear Physics."

Photo-alpha particles from eleven elements were observed by means of their tracks in Ilford E.1, 100-micron thick nuclear emulsions. Target foils placed between two emulsions were exposed to 21.5 Mev

bremsstrahlung hardened by 86.2 cm of graphite. The photo-alpha yields observed with the hardened spectrum are given in terms of unhardened bremsstrahlung, having been multiplied by the calculated ratio of effective photons in the two spectra. These yields, in units of 10^4 alphas per mole-roentgen, are: Al-1.3, V-0.4, Fe-1.9, Co-2.3, Ni-3.9, Cu-2.6, Cu^{63}-3.6, Zn-8.2, Nb-0.5, Rh-0.3, Ag-0.17, and In-0.09. For the seven elements having $Z \leq 30$, there seems to be a correlation between the yield and the difference between the neutron and alpha-particle binding energies. (auth)

21582

WIDTH DETERMINATION OF NARROW RESONANCES IN (γ,n) REACTIONS. M. Vakselj. p.665-6 of "Proceedings of the International Congress on Nuclear Physics."

Discontinuities in the slope, or "breaks," are interpreted as manifestations of narrow resonances in the cross section. Direct determination of the width is not possible due to errors in the measurement and due to the rather unknown thick target spectrum; the absorption measurement does not give the width either. Recent calculations of the high energy end of the γ-spectrum and experimental yield curves with and without absorber were used to estimate the upper and the lower limits for the half width. For the resonance at 21.12 Mev of carbon, the half-width is between 80 and 40 kev. (auth)

21583

THE PATH OF THE Na^{24}-RECOIL NUCLEI AND THE MECHANISM OF THE PHOTONUCLEAR REACTIONS $Al^{27}(\gamma,2pn)$, $Si^{28}(\gamma,3pn)$, $P^{31}(\gamma,4p3n)$, and $S^{32}(\gamma,5p3n)$ IN THE γ ENERGY RANGE UP TO 260 Mev. F. P. Denisov (Denissov) and P. A. Cherenkov (Cerenkov) (Lebedev Inst. of Physics, Academy of Sciences, USSR). p.676-81 of "Proceedings of the International Congress on Nuclear Physics." (In French)

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21584

PHOTODISINTEGRATION OF HELIUM. A. N. Gorbunov and V. M. Spiridonov (Lebedev Inst. of Physics, Academy of Sciences, USSR). p.682-92 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The results of the study of the photodisintegration of the He^4 nucleus are reported. The cross section of the reactions (γ,p), (γ,n), and (γ,pn) in helium was found as a function of the gamma energy and the angular distribution of the reaction products was measured. The curve of the total absorption cross section of photons by He^4 was also determined. The results were discussed with the intention of clarifying the mechanism of the interaction of gamma quanta of various energies with He^4. The experimental results were compared with the theoretical calculations of the photodisintegration cross section. (tr-auth)

21585

NUCLEAR DEFORMATION AND THE PHOTODISINTEGRATION GIANT RESONANCES. J. H. Carver and W. Turchinetz (Australian National Univ., Canberra). p.693-5 of "Proceedings of the International Congress on Nuclear Physics."

The effects of nuclear deformation and shell closure upon the photodisintegration giant resonances were investigated by measuring the (γ,n) cross sections for seven isotopes with $82 < N < 108$ using 33-Mev bremsstrahlung. It was found that the (γ,n) cross sections for the distorted nuclei Nd^{150}, Sm^{154}, Gd^{160}, and Ta^{181} have widths of 5.7, 6.5, 5.3, and 5.3 Mev, while for the closed-shell nuclei, Pr^{141}, Nd^{142}, and Sm^{144}, the cross sections have widths of 4.3, < 5.0, and 4.0 Mev. (W.D.M.)

21586

INELASTIC SCATTERING OF PHOTONS BY Ag^{107}. O. V. Bogdankevitch, B. S. Dolbilkin, L. E. Lazareva, and F. A. Nikolaev (Lebedev Inst. of Physics, Academy of Sciences, USSR). p.697-9 of "Proceedings of the International Congress on Nuclear Physics." (In French)

With the aid of the 30-Mev synchrotron, the yield curve for the reaction $Ag^{107}(\gamma,\gamma')Ag^{107m}$ was found. The curve calculated by the difference method has a peak ($\sigma_{max} \sim 2.3$ mbarn) in the vicinity of the (γ,n) reaction. In the energy interval from 12 to 28 Mev, the cross section for the $Ag^{107}(\gamma,\gamma')Ag^{107m}$ reaction increases regularly, attaining an energy ~25 Mev, a value equal to that of the maximum. (tr-auth)

21587

MEASUREMENT OF (γ,pn) REACTION FOR SOME LIGHT NUCLEI PHOTON ENERGIES WITHIN AND ABOVE THE GIANT RESONANCE. J. M. Reid, B. Lalovic, D. Balfour, D. Menzies, and J. R. Atkinson (Univ. of Glasgow). p.700-2 of "Proceedings of the International Congress on Nuclear Physics."

A part of the photodisintegration program at Glasgow has been directed toward a determination of the relative magnitude of the (γ,pn) reactions at energies at and above the giant resonance. Two different types of cloud chambers were used for the experiments on N, O, He, and Ne. The results are briefly summarized. (W.D.M.)

21588

STUDY OF THE FIRST COLLECTIVE LEVELS OF EVEN-EVEN NUCLEI BETWEEN THE MASSES 182 AND 206. R. Barloutaud, A. Lévêque, P. Lehmann, and J. Quidort (Centre d'Etudes Nucléarires, Saclay, France). p.703-9 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The reduced probabilities of de-excitation of the two first levels 2+ of W^{184}, W^{186}, Os^{188}, Os^{190}, Os^{192}, and Pt^{194} were determined from experiments of Coulomb excitation of the nuclei. The results are inserted in systematics of the properties of the two first levels 2+ of even-even nuclei lying between the masses 182 and 206. The variation of these properties as a function of the nuclear deformation is compared with various theoretical predictions concerning the vibration levels. (tr-auth)

21589

ON THE NUCLEAR DEFORMATION AS A CONSEQUENCE OF TWO-PARTICLE INTERACTIONS. B. F. Bayman (Univ. of Copenhagen). p.710-12 of "Proceedings of the International Congress on Nuclear Physics."

An attempt is made to determine the conditions under which a system of interacting nucleons will exhibit collective rotational properties. For the simple case of identical particles in the j^n configuration, it is shown that these properties are produced by the interaction $-\sum_{i<j} f_k(r_i,r_j)P_k(\cos\omega_{ij})$, provided that the adiabatic condition $4j \gg k(k+1)$, n, is obeyed. The moment of inertia of the resultant rotational spectrum agrees with that given by the cranking model. The argument may readily be extended to more general single-particle level sequences. (auth)

21590

ISOTOPE SHIFT AND NUCLEAR STRUCTURE. A. R. Bodmer (C.E.R.N., Geneva). p.718-23 of "Proceedings of the International Congress on Nuclear Physics."

A new derivation of the expression for the nuclear charge distribution dependent isotope shift (I. S.) was obtained. This derivation shows clearly what approximations are made. The result, essentially the same as already obtained previously by the author but which is not well known, is as simple as the perturbation expression for the I. S. but is independent of the uncertainties of this. It depends on the charge distribution only through the root-mean-square radius, $(r^2)^{\frac{1}{2}}$, and the change of this, $\delta(r^2)^{\frac{1}{2}}$, between isotopes. The implication of the electron scattering results for the I. S. are considered both for its dependence on $(r^2)^{\frac{1}{2}}$ and on $\delta(r^2)^{\frac{1}{2}}$. A renewed discussion is given of the effect of nuclear compressibility on the I. S. first considered by Wilets, Hill, and Ford. For this the dependence of the symmetry energy on the density is shown to be as important as the coulomb energy. Thus the I. S. cannot be uniquely related to the compressibility coefficient of nuclear matter but may now however be used to obtain information about the dependence of the symmetry energy on the density. (auth)

21591

THE ENERGY LEVELS OF ^{31}P AND A POSSIBLE INTERPRETATION ON THE UNIFIED MODEL. C. Broude, L. L. Green, and J. C. Willmott (Univ. of Liverpool). p.724-29 of "Proceedings of the International Congress on Nuclear Physics."

From an experimental study of the reaction $Si^{30}(p,\gamma)P^{31}$ the spins, parities, branching ratios, and some E2/M1 radiation mixing ratios were obtained for the first six excited states of P^{31}. A detailed comparison of these results with the Nilsson model was made. With oblate deformation a reasonable interpretation of the spins and positions of the first six excited states can be obtained. The branching ratios and E2/M1 mixing ratios predicted by the Nilsson wave functions which would be required by this interpretation show that these may not be very realistic. (auth)

21592

ON THE CALCULATION OF g_R-FACTORS USING UNIFIED MODEL WAVE FUNCTIONS. S. Goshen and H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel). p.743-5 of "Proceedings of the International Congress on Nuclear Physics."

The g_R-factor was calculated for a two-dimensional nucleus described by anisotropic harmonic oscillator wave functions. In order to calculate the g_R-factor for this system, it was necessary to determine how the total orbital angular momentum of the system is divided between the neutrons and the protons. (W.D.M.)

21593

LEVEL ASSIGNMENTS IN ^{18}O FROM THE REACTION $^{14}C(\alpha,\gamma)^{18}O$. H. E. Gove and A. E. Litherland (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.746-8 of "Proceedings of the International Congress on Nuclear Physics."

Capture gamma rays from alpha-particle bombardment of C^{14} were investigated at two resonances at laboratory energies of 1.79 and 1.14 Mev. These correspond to levels in O^{18} at excitation energies of 7.63 and 7.13 Mev respectively. Direct correlations of the gamma rays with respect to the proton beam were measured at each resonance which permitted unambiguous spin and parity assignments to be made to a number of levels in O^{18}. (auth)

21594

THE ENERGY DEPENDENCE OF FISSION FRAGMENT ANISOTROPY. J. J. Griffin (Los Alamos Scientific Lab., N. Mex.). p.749-53 of "Proceedings of the International Congress on Nuclear Physics."

The energy dependence of fission fragment anisotropy is estimated according to the theory of A. Bohr, by incorporating detailed assumptions about the distribution K, the projection of angular momentum along the nuclear symmetry axis, and the dependence of this distribution on the energy in excess of the fission barrier. For energies barely in excess of the barrier, one expects few enough K-valves to be accessible that significant deviations from the statistical behavior will occur. (W.D.M.)

21595

SINGLE PARTICLE ENERGIES IN A FERMI GAS WITH INTERACTION. N. M. Hugenholtz (Rijksuniversiteit, Utrecht). p.754-8 of "Proceedings of the International Congress on Nuclear Physics."

Single particle properties in a gas of interacting Fermi particles at zero temperature are discussed. If no approximations are made, it appears that a single particle energy has a meaning only for particles of momentum $|k|$ close to the Fermi momentum k_F. These particles are metastable. In the limit $|k| \to k_F$ they become stable particles. The single particle energy in this limit is called the Fermi energy E_F. The result that a nucleon of momentum close to k_F, moving through nuclear matter, has a long mean free path, is a rigorous theoretical justification of the optical model. An important relation between the Fermi energy E_F and the average energy of the whole system in its ground state E_0/N, which in the case of nuclear matter gets the simple form $E_F = E_0/N$, is used to reveal a large inconsistency in the theory of Brueckner. It is shown that Brueckner's definition of single particle energies is very inaccurate, due to the neglect of important cluster terms. This has strong influence on the calculation of the optical potential and the effective mass. (auth)

21596

COLLECTIVE VARIABLES AND ROTATIONAL ENERGY SPECTRA. H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel). p.761-4 of "Proceedings of the International Congress on Nuclear Physics."

Bohr and Mottelson have shown that rotational spectra can be found in systems where a collective angle operator can be defined satisfying certain operator equations. A more general type of collective variable is defined here and conditions for the existence of rotational spectra are obtained. A possible relation between the shell model and the collective model is discussed in terms of these variables. This is shown to be applicable in the Elliott model. (auth)

21597

COULOMB EXCITATION OF THE SECOND 2+ STATE IN EVEN-EVEN NUCLEI. F. K. McGowan and P. H. Stelson (Oak Ridge National Lab., Tenn.). p.765-71 of "Proceedings of the International Congress on Nuclear Physics."

Measurements of the weak Coulomb excitation of the second 2+ state in 11 medium weight even-even nuclei have provided information on the values of the B(E2) for decay of the second 2+ state. The upper cascade B(E2)

is, within experimental error, twice as large as the B(E2) for the lower cascade transition. This is confirmation of the prediction of the vibrational model for spherical nuclei. Coulomb excitation of the second 2+ state was established for 6 even-even nuclei of W, Os, and Pt. These nuclei are in the transition region where the nuclear deformation is decreasing and the nuclear shape becomes spherical. The measured linear polarization of the 740-kev γ ray from the transition between the 2+ vibrational state and the 2+ rotational state of Th^{232} is consistent with an assignment of E2 radiation. (auth)

21598

RESIDUAL INTERACTIONS IN THE NUCLEAR SHELL MODEL. S. A. Moszkowski (Univ. of California, Los Angeles). p.776-80 of "Proceedings of the International Congress on Nuclear Physics."

It is suggested to treat the attractive part of the two-nucleon interaction essentially by perturbation theory. In this way one can approximately separate the attractive interaction into a contribution to the average potential and a residual interaction which represents the second order effect of this interaction. By assuming that the attractive interaction is non-local but factorable, an explicit expression for the residual interactions may be obtained. It is shown that the residual interaction defined in this way acts mainly under two conditions at the nuclear surface giving rise to collective oscillations and in nuclear matter between particles of approximately equal and opposite momenta and near the top of the Fermi sea, which gives the pairing effect. (auth)

21599

NUCLEI OF THE SPIN SEQUENCE 0-2-2. M. Sakai (Univ. of Tokyo). p.781-5 of "Proceedings of the International Congress on Nuclear Physics."

The systematics of even-even nuclei which have the so-called vibrational levels was treated. Two groups were observed. The first group appears in island pattern in four regions where in the neutron or proton configuration an energetically higher orbit of a large angular momentum competes with a spin $\frac{1}{2}$ orbit by reason of the large pairing energy. This group has in general the spin sequence of 0-2-2. The second group appears just near the magic number and the spin sequence is always 0-2-4. Special attention was paid to the sign and the behavior of the mixing ratio, δ, of the upper $2 \rightarrow 2$ transition in nuclei of the first group. The sign of δ in neutron island alternates from one to the other island so far as the results experimentally obtained up to the present are concerned and the δ value diminishes as the neutron number approaches to the magic number. From the present studies the excitation mechanism of vibrational levels could be discussed in the framework of single particle aspect. (auth)

21600

NUCLEAR VIBRATIONS AND THE SPECTRUM OF ^{114}Cd. G. R. Satchler (Clarendon Lab., Oxford). p.786-7 of "Proceedings of the International Congress on Nuclear Physics."

The spectrum and decay characteristics of Cd^{114} were studied using a simple model of a weak quadrupole coupling between the collective harmonic vibrations and the intrinsic particle states. Qualitatively, good agreement with experiment is obtained, but discrepancies remain in detail. (auth)

21601

CLUSTER STRUCTURES IN THE ATOMIC NUCLEI. K. Wildermuth and Th. Kanellopolous (C.E.R.N., Geneva). p.793-7 of "Proceedings of the International Congress on Nuclear Physics."

A method is discussed which makes it possible to see that in nuclei many different cluster structures are present. What cluster structures are preferred depends on the nuclear forces, and can change from nucleus to nucleus and from level to level. For instance it can be seen that in the low energy states of Be^8 two α-particle clusters are present, in the low energy states of F^{19} partly $O^{16} + H^3$ clusters and very probably partly $N^{15} + \alpha$-particle clusters. The asymmetric fission indicates that also very big clusters in the nuclei are present. By generalization of this method it is possible to investigate some general features of the rotational states. It comes out that two different kinds of rotational states are existing. (auth)

21602

NUCLEI WITH AXIAL ASYMMETRY. B. T. Geilikman (Academy of Sciences, USSR). p.801-5 of "Proceedings of the International Congress on Nuclear Physics." (In French)

This paper was previously abstracted from Zhur. Eksptl'. i Teoret. Fiz. 35, 989-91(1958) Oct. and appears in NSA, Vol. 13, as abstract No. 4187.

21603

THE APPLICATION OF THE METHOD OF SELF-CONSISTENT FIELD TO ATOMIC NUCLEI. A. S. Kompaneets (Kompaneiets) (Academy of Sciences, USSR, Moscow). p.808-12 of "Proceedings of the International Congress on Nuclear Physics."

It was long thought that the method of self-consistent field was not applicable to nuclei, as the nuclear forces have a short range of action and the nucleon does not interact with the nucleus as a whole. But there exist nuclear shells with definite values of angular momenta of separate nucleons. Therefore the notion of self-consistent field is in some sense reasonable if applied to nuclei. The consequent application of the self-consistent field methods leads to the Fock equations which are exactly equivalent to the equation for the density matrix. (W.D.M.)

21604

COLLECTIVE EFFECTS IN F^{17} AND Ne^{19}. P. Lehmann, A. Lévêque, T. Grjebine, and R. Barloutaud (Centre d'Etudes Nucléaires, Saclay, France). p.813-17 of the "Proceedings of the International Congress on Nuclear Physics." (In French)

The periods of quadrupole transitions F^{17} $1/2+ \rightarrow 5/2+$ and Ne^{19} $5/2+ \rightarrow 1/2+$ were measured and are compatible with the model of weak coupling between the core and exterior nucleons. (tr-auth)

21605

ENERGY LEVELS OF NUCLEONS IN STRONGLY DEFORMED NUCLEI. D. A. Zaikin (Zaikine) (Academy of Sciences, USSR). p.818-24 of the "Proceedings of the International Congress on Nuclear Physics." (In French)

The method of asymptotic development is applied to the calculation of the energy levels for an ellipsoidal nucleus. The behavior of a nucleon in a well of infinite depth with vertical walls and having (in space) the form of an ellipsoid of revolution is considered. Numerical

calculations were made for particular case $V_0 = 50$ Mev, A−15, and A−216, where V_0 is the depth of the well and A is the constant of spin-orbit coupling. (J.S.R.)

21606

SUPERFLUIDITY OF NUCLEAR MATTER AND NUCLEAR STRUCTURE. A. Migdal. p.826-7 of "Proceedings of the International Congress on Nuclear Physics." (In Russian)

The Gorkov method (Zhur. Eksptl'. i Teoret. Fiz. 34, No. 3(1958)) is used to generalize for finite systems the methods used to describe infinite superconductors. An equation for the moment of inertia is derived. The use of the method in determining nuclear structure is discussed. (J.S.R.)

21607

THE DEVELOPMENT OF THE GIBBS POTENTIAL. C. Bloch and C. De Dominicis (Centre d'Etudes Nucléaires, Saclay, France). p.828-9 of "Proceedings of the International Congress on Nuclear Physics." (In French)

By utilization of the formalism of the second quantization, the power development of the chemical activity e^{α} of the Gibbs potential can be established for a system of particles in interaction. By partial summation a second form of development is found where the free propagators are replaced by propagators in a system of particles without interaction. The Gibbs potential can be developed as a function of the number of particles in interaction. The contribution of binary collisions to the bonding energy of the ground state can be found. (J.S.R.)

21608

BETA-GAMMA CORRELATIONS FROM POLARIZED NUCLEI. E. Ambler, R. W. Hayward, D. D. Hoppes, and R. P. Hudson (National Bureau of Standards, Washington, D. C.). p.831-5 of "Proceedings of the International Congress on Nuclear Physics."

The original experiments with polarized Co^{60}, studying anisotropy in the β emission, demonstrated the nonconservation of parity in β decay. The decay of Co^{60}, being governed solely by the Gamow-Teller interaction, is less general than a $J \rightarrow J$ transition where both Fermi and G-T interactions can be involved and where effects due to interference between them can occur. The detailed features of the β decay of polarized nuclei are very sensitive to the Fermi to G-T mixing ratio and as a result one has a new and powerful method for determining nuclear matrix elements (more exactly, the product of coupling constant and matrix element). The β asymmetry and β-γ angular correlation were studied for polarized Co^{58} and Mn^{52} nuclei. Only the Mn^{52} shows a measurable interference, with a significant enhancement of the β asymmetry. By combining the asymmetry and angular correlation results, it is possible to determine the mixing ratio accurately and unambiguously and θ, the phase angle between C_A and C_V to within fairly narrow limits. The value of θ has a direct bearing on the question of time-reversal invariance. (auth)

21609

C, P, T SYMMETRIES IN THE BETA DECAY OF THE NEUTRON. M. T. Burgy, V. E. Krohn, T. B. Novey, and G. R. Ringo (Argonne National Lab., Lemont, Ill.). and V. A. Telegdi (Univ. of Chicago). p.836-9 of "Proceedings of the International Congress on Nuclear Physics."

A series of new measurements were completed on the beta decay of polarized neutrons which gave the directional correlations of beta particles and neutrinos with respect to the direction of the neutron spin. The results of these measurements uniquely determine the beta decay coupling to be predominantly V-A, that is vector and axial vector with a phase difference of 180 ± 30° and are in agreement with the ratio of vector and axial vector coupling constants previously obtained, $C_A^2/C_V^2 = 1.3$. The results to date thus are in agreement with CP and T invariance of the beta decay coupling. (auth)

21610

THE ELECTRON NEUTRINO/ANGULAR CORRELATION IN THE DECAY OF ^{6}He. J. Csikai and A. Szalay (Atomki, Debrecen, Hungary). p.840-9 of "Proceedings of the International Congress on Nuclear Physics."

The recoil effect of the neutrino was detected by means of Wilson chamber photos of the β-decay of He^6. Among 4,000 stereoscopic pairs of photos altogether 381 He^6 β-tracks were observed and the impulse and direction of the neutrino were measured. The angular correlation between neutrino and electron demonstrates significantly that the form of interaction is a tensoric one. (auth)

21611

MAGNETIC-LENS SPECTROMETER MEASUREMENT OF v/c-DEPENDENCE OF THE BETA-CIRCULARLY POLARIZED GAMMA CORRELATION IN ^{60}Co. L. A. Page, B.-G. Pettersson, and T. Lindqvist. p.853-5 of "Proceedings of the International Congress on Nuclear Physics."

Measurement is made of the circular polarization of Co^{60} gamma rays in coincidence with beta rays whose momentum is defined by a magnetic lens spectrometer. The gamma are analyzed by a transmission type Compton analyzer of new shape (toroidal). At nominal 180° between beta and gamma, and accepting both of the gamma lines, the degree of circular polarization as a function of v/c is noticeably higher than ÷ 0.33 v/c and markedly so for the smaller speeds. Proceeding downward in v/c from 0.70 to 0.35 there is no indication that the polarization falls off as fast as would be given by a "v/c-law." (auth)

21612

DEDUCTIONS CONCERNING THE BETA DECAY PROCESS BASED ON ANALYSIS OF K-CAPTURE-POSITRON RATIOS. M. L. Perlman, J. P. Welker, and M. Wolfsberg (Brookhaven National Lab., Upton, N. Y.). p.856-60 of "Proceedings of the International Congress on Nuclear Physics."

The theory for the relative probabilities of K-electron capture and of positron emission is investigated in the cases of allowed and first-forbidden transitions. Comparison is made between theoretical and experimental results for allowed and "unique" first-forbidden transitions, and upper limits for the Fierz term are set. The general expression for first-forbidden decay probability is presented, together with representative values of parameters appearing therein. Arguments are made on the basis of which K/β^+ ratios are estimated for various types of first-forbidden transitions; and the experimental results for three $\Delta J = 0$ transitions are compared with the estimates. (auth)

21613

DIRECTIONAL CORRELATION AND INTERNAL CONVERSION MEASUREMENTS ON ^{152}Eu^m. G. T. Wood and O. Nathan (Univ. of Copenhagen). p.861-4 of "Pro-

ceedings of the International Congress on Nuclear Physics."

The spins and parities of the 1327 kev level in Gd^{152} and the 1502 kev level in Sm^{152} are discussed on the basis of γ-γ directional correlation and internal conversion measurements. The 1327 kev level was assigned spin and parity 1—. The 1502 kev state was assigned spin 1 or 3 and its parity is most likely even. (auth)

21614

THE NATURE OF THE GAMOW-TELLER INTERACTION DURING THE DISINTEGRATION OF Li^8. K. H. Lauterjung and B. Schimmer (Max-Planck-Institut fur medizinsche Forschung, Heidelberg, Ger.) and H. Maier-Leibnitz (Technische Hochschule, Munich). p.866-8 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The electron-antineutrino angular correlation was determined for the decay of Li^8. Since this decay occurs mainly through the Gamow-Teller interaction, the correlation should be sensitive to the ratio of axial- to tensor-coupling. Theoretical curves for T, A, and a mixture of equal parts of T and A are given. The experimental results are best consistent with the curve for A-coupling. (auth)

21615

ELECTRON POLARISATION OF ^{60}Co. H. Bienlein, H. von Issendorff, and H. Wegener (Universite d'Erlangen, Ger.). p.872-3 of "Proceedings of the International Congress on Nuclear Physics."

The longitudinal polarization of Co^{60} electrons was measured at various energies by Mott-scattering with an accuracy of 2%. The results are summarized. The depolarization in the source and the influence of double and small angle scattering in the scattering foil were taken into account. The small deviations of full polarization at small energies may be produced by the screening of the Coulomb field. (auth)

21616

THE ELECTRON POLARISATION IN THE β-DECAY OF RaE (^{210}Bi). W. Buhring and J. Heintze (Universität, Heidelberg, Ger.). p.877-9 of "Proceedings of the International Congress on Nuclear Physics."

The polarization of Bi^{210}(RaE) was measured by using a previously described method. The electrons were deflected by multiple scattering. This produces a well defined transversal component of the original longitudinal polarization. This component can be measured by Mott-scattering. The instrument is sensitive to electrons in an energy range from ~250 to 500 kev. (W.D.M.)

21617

STUDY OF γ TRANSITIONS OF THE F^{20} NUCLEUS. S. Gorodetzky, Th. Muller, G. Bergdolt, and M. Port (Institut de Recherches Nucléaires, Strasbourg). p.885-7 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The gamma transitions from the excited levels of F^{20} were examined. The energy levels 0.65, 0.83, 0.99, 1.06, and 1.31 Mev are all de-excited by a direct transition to the ground level. The 0.99-Mev direct transition is accompanied by a cascade transition passing through the 0.65-Mev level. The 2.05-Mev level is de-excited by a transition passing through the first excited level. (tr-auth)

21618

COMMENTS ON FORMULATIONS OF ANGULAR DISTRIBUTIONS OF NUCLEAR PROCESSES. R. Huby (Univ. of Liverpool). p.895-9 of "Proceedings of the International Congress on Nuclear Physics."

Some difficulties of using angular distribution formulas are pointed out. These arise from conflicting notations of different authors, and indirect definitions. Some data are presented to help systematize electromagnetic transitions. These are comparative tables of multipole vector potentials and reduced matrix elements, with formulas for calculation of the latter. (auth)

21619

ALPHA-DECAY AMPLITUDES AND THEIR PHASES. B. A. Jacobsohn and L. W. Miller (Univ. of Washington, Seattle). p.900-4 of "Proceedings of the International Congress on Nuclear Physics."

A method is given for explicitly separating the resonant from the non-resonant effects. The latter correspond physically to Coulomb excitation (or de-excitation) of the nucleus by the alpha when it is outside the barrier; although this part of the coupling is weak, the small $l = 4$ amplitude is much altered by its coupling to the strongly populated $l = 2$ channel. This effect provides all of the phase (beyond the usual Coulomb monopole phases) of the amplitudes; excellent agreement with a machine calculation is found. Semi-empirical curves are presented for the $l = 4$ amplitudes as a function of mass number for even A; the imaginary part remains almost constant while the real part changes sign, going through zero near $A \sim 244$. A method is sketched for predicting the real and imaginary parts of the odd-A amplitudes, and numerical results are presented for U^{233} and Am^{241}. Finally, a brief discussion is given of ways in which the cos and sin of the phases may in principle be measured. (auth)

21620

PERIOD OF THE FIRST EXCITED STATE OF Mo^{95} AND THE CONVERSION COEFFICIENT OF THE RADIATION EMITTED. C. Lévi, L. Papineau, and J. Quidort (Centre d'Etudes Nucléaires, Saclay, France). p.905-6 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The direct measurements of the 200-kev level and the conversion coefficients of the gamma radiation emitted are in good agreement with the predictions of McGowan and Stelson (Phys. Rev. 109, 901(1958)). (tr-auth)

21621

EVEN PARITY LEVELS OF LOW ENERGY IN THE ARSENIC NUCLIDES. H. J. Van den Bold (Rijksuniversiteit, Utrecht). p.907-9 of "Proceedings of the International Congress on Nuclear Physics."

By directional and polarization correlation measurements on the 121 – 280 kev gamma cascade in As^{75} an even parity was indicated for the 401 kev level. Even parities were already suspected for other low energy levels in As^{73}, As^{75}, and As^{77}. The occurrence of even parity levels in these nuclides can be explained if it is assumed that they are combination levels of the $g_{9/2}$ shell which presumably is filling pairs even at 33 protons. (auth)

21622

SOME FINE STRUCTURES IN THE RADIUM FAMILY. R. J. Walen and G. Bastin (C.N.R.S., Bellevue, France). p.910-16 of "Proceedings of the International Congress on Nuclear Physics." (In French)

Low background α spectrography of Ra and derivatives shows fine structures in the α spectra of Ra, Rn, Po^{218}, At, and Po^{214}. Levels known previously through γ measurements were confirmed. (auth)

21623
ELECTRIC MONOPOLAR TRANSITIONS. T. Yuasa and J. Laberrigue-Frolow (Collège de France, Paris) and L. Feuvrais (Laboratoire de synthèse atomique, Ivry, France). p.917-21 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The experimental data obtained for a O+ → O+ transition in Zr^{90} is reported and compared with the theoretical data. The experimental values for the intensity of the nuclear interaction of known electric monopolar transitions $|\rho|^2$ are compared with the theoretical values. It is concluded that $|\rho|^2$ decreases when A increases and $|M|^2$ is not sensitive to the variation of A. (tr-auth)

21624
RARE EMISSION OF RADIOELEMENTS. M. Ader and M. P. Cabannes (College de France, Paris). p.922-3 of "Proceedings of the International Congress on Nuclear Physics." (In French)

The abnormally long-range particles emitted by the radioelements do not appear to arise from a secondary effect: (α,p) reaction on the constituents of the air. An analysis of their tracks in nuclear emulsions leads to the conclusion that they are less ionizing than alpha particles. (tr-auth)

21625
RELATIVISTIC CORRECTIONS FOR THE ENERGY LEVELS OF LIGHT NUCLEI IN THE PHENOMENOLOGICAL THEORY. F. A. Zhivopistesev (Givopisetsev), A. M. Perelomov, and Yu. M. Shirokov (Iu. M. Chirokov) (Moscow State Univ.) p.925-8 of "Proceedings of the International Congress on Nuclear Physics." (In French)

This paper was previously abstracted from Zhur. Eksptl'. i Teoret. Fiz. 36, 478-80(1959) Feb. and appears in NSA, Vol. 13, as abstract No. 10522.

21626
ON THE DECAY OF $^{128}Ba \rightarrow {}^{128}Cs \rightarrow {}^{128}Xe$. T. Novakov, S. Koički, and M. Mladjenović (Institute of Nuclear Sciences "Boris Kidric," Belgrade) and E. Arbman (Gustaf Werner Institute for Nuclear Chemistry, Uppsala). p.935-6 of "Proceedings of the International Congress on Nuclear Physics."

In a preliminary study of the decay of $Ba^{128} \rightarrow Ca^{128}$, the conversion electron spectra were measured in a lens spectrometer and in a permanent magnet spectrometer. The gamma spectrum was measured by a NaI scintillation spectrometer. Conversion spectra: K 160.0 or L 133.9, K 277.7, K and L 441.5, K 527.8, and K 576.3 conversion lines were found and assigned to the decay of $Ba^{128} - Cs^{128}$ mixture. Strong conversion lines of the 276.0 kev isomeric transition in Ba^{133m}, and some lines belonging to the decay of Ba^{131} were seen. (W.D.M.)

21627
ON THE LEVEL SCHEME OF ^{192}Pt. M. Mladjenovic and T. Novakov (Institute for Nuclear Sciences "Boris Kidric," Belgrade). p.938-9 of "Proceedings of the International Congress on Nuclear Physics."

The gamma spectrum of Pt^{192} was measured with a 50 cm radius iron-free double-focusing spectrometer, by the external photo conversion method. The levels of 921 and 784 kev are briefly discussed. (W.D.M.)

21628
THE ELECTROMAGNETIC RADIATION OF LIGHT NUCLEI. A. K. Kaminskii (Kaminsky) and Yu. M. Shirokov (Iu. M. Chirokov) (Moscow State Univ.). p.940-5 of "Proceedings of the International Congress on Nuclear Physics." (In French)

A detailed study is made of influence of the Coulomb corrections on the position of the energy levels of light nuclei. The mean quadratic radius of the light nuclei up to Be^8 (inclusive) is calculated for the ground states. The calculations are based on the experimental data on the isotopic multiplets and on the scattering of high-energy electrons by the nuclei. The wave functions of an oscillator are used. The manner in which the radius depends on the number of nucleons of the nucleus and its excitation is considered. It is proved that for all the nuclei, except the nuclei of the He^5-Li^5 doublet, the radius is a regular function of the energy. The 19.2-Mev level of Be^8 was identified precisely. (tr-auth)

Theory

21629 AFCRC-TN-58-592
New York Univ., New York. Inst. of Mathematical Sciences.
MULTIPLE SCATTERING IN ONE DIMENSION. Jack Bazer. Jan. 1959. 72p. Contract AF19(604)-3495. (EM-122; AD-207910).

A rigorous treatment is given of two basic types of one-dimensional problems in the theory of the multiple scattering of waves by distributions of point scatterers. The first problem concerns scattering by a single configuration of scatterers with fixed but arbitrary positions in the finite scattering interval. The second problem concerns scattering from an ensemble of configurations, the ensemble arising out of the assumption that the scatterer positions are random variables. In each problem the solution u^n (n denotes the number of scatterers) is approximated by the solution U^n of a continuum problem that results when the discrete distribution function $W^n(x)$, characterizing the spatial distribution of scatterer positions, is replaced by a suitable approximating continuous distribution function $W(x)$. In both problems the object is to determine conditions which ensure that u^n is approximated, in an appropriate sense, by U^n. Our procedure consists basically in deriving estimates of the maximum modulus of (i) $u^n - U^n$, (ii) u^n minus a sum of terms having U^n as a dominant term, and (iii) the average of these quantities. These estimates are then employed to obtain sufficient conditions that ensure a small error of approximation. Both the estimates and the sufficient conditions are expressed solely in terms of the basic parameters of the problem – i.e., the number of scatterers, the free space wave number, the length of the scattering region, and the magnitude of the ratio of scatterer impedance to the free space wave impedance. The fact that $W(x)$ is "close" to $W^n(x)$ is also taken into account. Results provide rigorous justifications, in a one-dimensional setting, for two formal procedures now in wide use. (auth)

21630 AFSWC-TR-58-46
Republic Aviation Corp. Missile Systems Div., Mineola, N. Y.
AN OUTLINE OF THE BASIC THEORY OF MAGNETO-HYDRODYNAMICS. P. N. Hu. Nov. 15, 1958. 67p. Project No. 5776. Contract AF29(601)-1218. (MSD-206-950-2; AD-208851).

A survey of the basic theory of magnetohydrodynamics is given together with a review of the fundamental concepts of electrodynamics and the motion of a charged particle. The basic equations used for a viscous, heat-conducting, radiating, electrically-conducting, and compressible fluid are Maxwell's equations, the momentum equation, the continuity equation, the ideal gas law, the energy equation, and Ohm's law. The most general form of these equations is derived and then reduced to various approximate forms. The associated boundary conditions for the electric and magnetic fields, pressure, velocity, and heat energy are also derived. Solutions to several problems are noted. (auth)

21631 WCAP-1097

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

CALCULATION OF DANCOFF CORRECTION. V. Namias. Feb. 1959. 18p.

In a close-packed lattice the surface resonance absorption is reduced due to the presence of the neighboring fuel rods. The effect of these fuel rods is to deplete the flux of the resonance energies which contribute to the surface absorption of a single fuel rod considered. Dancoff and Ginsburg worked out an analytical study of this effect and an outline of their theory is given. The Dancoff integral is calculated. (W.D.M.)

21632 XDC-59-4-12

A NEW APPROXIMATE METHOD FOR SOLVING FREDHOLM INTEGRAL EQUATIONS OF THE SECOND KIND: THE METHOD OF AVERAGING FUNCTIONAL CORRECTIONS. A. Yu Luchka. Translated by James F. Heyda (General Electric Co. Aircraft Nuclear Propulsion Dept.) from Doklady Akad. Nauk S.S.S.R. 122, 179-82(1958). 8p. $1.80(ph), $1.80(mf) JCL or LC.

An entirely new method, different from the usual method of successive approximations, is presented. A condition sufficient to guarantee convergence under stated conditions is derived and an example is given for which the present method succeeds but for which the usual method fails. (auth)

21633

ON THE GENERAL THEORY OF COLLISIONS FOR PARTICLES WITH SPIN. M. Jacob and G. C. Wick (Brookhaven National Lab., Upton, N. Y.). Ann. Phys. (N. Y.) 7, 404-28(1959) Aug.

The general analysis of binary reactions involving particles with arbitrary spin is reformulated in such a way that it applies equally well to relativistic particles (including photons). This is achieved by using longitudinal spin components ("helicity states") not only in the initial and final states, but also in the angular momentum states which are employed as usual to reduce the S-matrix to a simpler form. Expressions for the scattering and reaction-amplitude, intensity, and polarization are given. They involve fewer vector-addition coefficients than the customary formulas, and no recoupling coefficients. The application to some examples is sketched, and in the Appendix some formulas are given that may be of use in the applications. (auth)

21634

ANALYTIC PROPERTIES OF THE AMPLITUDE FOR THE SCATTERING OF A PARTICLE BY A CENTRAL POTENTIAL. Abraham Klein (Univ. of Pennsylvania, Philadelphia) and Charles Zemach (Univ. of California, Berkeley). Ann. Phys. (N. Y.) 7, 440-55(1959) Aug.

A new proof is given that the scattering amplitude, considered as a function of energy, for fixed momentum transfer, has those analytic properties in the energy variable which imply a dispersion relation. The proof is based on the known behavior of the Green's function, as the resolvent of a self-adjoint transformation, and on the study of the Born series. The class of potentials considered is the same as in previous studies. It is shown that for potentials of arbitrary strength the Born series converges uniformly to its first term for sufficiently high energies, real or complex. The analytic properties of the scattering amplitude as a function of momentum transfer for fixed real energy are also investigated and used to establish the domain of convergence of partial wave and related expansions. In particular the use of such expansions to define the amplitude in the unphysical region which occurs in the dispersion relation is fully justified for the same domain of momentum transfer for which the relation itself is valid, i.e.: $\Delta < 2\alpha$, where Δ is the momentum transfer and α^{-1} the range of the potential. All proofs apply equally to the Schroedinger and to the Klein-Gordon equations. (auth)

21635

FIELD THEORY COMMUTATORS. Julian Schwinger (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters 3, 296-7(1959) Sept. 15.

It is customary to assert that the electric charge density of a Dirac field commutes with the current density at equal times, since the current vector is a gauge-invariant bilinear combination of the Dirac fields. It follows from the conservation of charge that the charge density and its time derivative, referring to any pair of spatial points at a common time, are commutative. (W.D.M.)

21636

SPIN-ORBIT POTENTIAL WITH PION SCATTERING CORRECTION. Susumu Okubo (Univ. of Rochester, N. Y.) and Shinji Sato (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 383-8(1959) Mar.

The dispersion relation for $\pi-N$ scattering is applied in calculating the two-body spin-orbit potential. Numerical results obtained are not in close agreement with the shell model as to magnitude and sign. (C.J.G.)

21637

MOMENTUM DEPENDENCE OF THE HEALING DISTANCE. Takashi Tagami (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 465-8(1959) Mar.

A plausible analytic expression is derived for the "healing distance" and its momentum dependence is discussed quantitatively, based on Bethe-Goldstone's equation for an imbedded nucleon pair whose center-of-mass is assumed to be at rest. (C.J.G.)

21638

ON THE INTERMEDIATE RESONANCE LEVELS IN THE NUCLEAR REACTIONS. Sin-iti Igarasi, Ko Izumo, and Takeshi Udagawa (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 468-71(1959) Mar.

Nuclear reactions at intermediate energy have been interpreted by means of either direct reaction or of the statistical model. It is possible the mechanism of nuclear processes in this energy region lies somewhere between the two mechanisms. A nuclear model, based on the above mechanism, is used to interpret the experimental data on differential cross sections of the Ni(p,p')Ni* reaction. (C.J.G.)

RADIATION EFFECTS ON MATERIALS

21639 AERE-R-2983

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE RELEASE OF FISSION PRODUCT GASES FROM A THIN FILM OF U_3O_8 DURING IRRADIATION IN THE DIDO REACTOR. F. J. Stubbs, P. J. Russell, and G. N. Walton. July 1959. 35p. $0.77(BIS).

Quantitative measurement of the rate of release of some longer lived rare gases is described, and the results are compared with those obtained in a similar experiment in the BEPO reactor. Results show that, from a thin film, fission recoil is the major effect. Difficulties were encountered in measuring some of the rare gases with short half lives owing to interference from daughter products and the multiplicity of gamma peaks, and for the gases with long half lives diffusion from the walls of the irradiation vessel becomes important. The characteristics of the apparatus are described and some results are given of neutron flux and temperature distribution which were taken during the period of reactor start up. (auth)

21640 DP-369

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

STRESS RELAXATION IN STAINLESS STEEL DURING IRRADIATION. J. Walter Joseph, Jr. June 1959. 30p. Contract AT(07-2)-1. $1.00(OTS).

Neutron irradiation caused elastic stresses that were produced by a fixed amount of deformation to relax as much as 10,000 psi in specimens of Type 304 stainless steel that were loaded in tension and were exposed in a nuclear reactor at a temperature below 100°C. The maximum exposure was 9×10^{20} fast neutrons per square centimeter. Tensile strength, yield strength, and hardness of these specimens were increased by irradiation. (auth)

21641 IGR-145(RD/C)

United Kingdom Atomic Energy Authority. Industrial Group H, Q., Risley, Lancs, England.

BRITTLENESS IN METALS — A CONFERENCE HELD AT R & D BRANCH CULCHETH LABORATORIES ON 1st NOVEMBER, 1957. May 12, 1959. 56p. $0.70 (BIS).

A collection of papers on various aspects of brittleness in metals is presented which was given at a conference held at U.K.A.E.A. Culcheth Laboratories in November 1957. Papers were included on theory of brittle fracture in steel, transition temperature in notched specimens, neutron effects on steel, ductile-brittle transition in non-ferrous metals, cleavage fracture in hexagonal metals, and the ductility problem of reactor beryllium. (W.D.M.)

21642 NP-7904

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 27 [ON RADIATION EFFECTS DATA]. Sept. 15, 1959. 25p. Project No. 2133. Contract AF33(616)-6564.

21643 REIC-8

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS. H. Cary, J. F. Hansen, W. E. Chapin, E. N. Wyler, and H. S. Scheffler. July 31, 1959. 29p. Project No. 2133. Contract AF33(616)-6564. (AD-214697)

The status of knowledge of the effects of nuclear radiation on basic electronic parts from 1957 to 1959 and attempts to relate the observed degradation of the electrical characteristics of each device to the materials used in the construction of the device are presented. The statements made are not intended to be design oriented but rather to survey the relative radiation sensitivity of electronic components and to provide a basis for judging the merits of any technical approach for applying electronic circuitry in a radiation environment. (auth)

21644 WADC-TR-59-348

General Electric Co. Specialty Transformer Dept., Fort Wayne, Ind.

ULTRA HIGH TEMPERATURE (500°C) POWER TRANSFORMERS AND INDUCTORS. Harold B. Harms and James C. Fraser. June 30, 1959. 582p. Project title: IMPROVED ELECTRONIC TECHNOLOGY COMPONENTS. Contract AF33(616)-5579.

Objectives of the program call for the development of electronic power transformers capable of operation in a 500°C ambient temperature and in intense nuclear radiation. Breakdown potential of air up to 500°C temperature and in a radiation environment was measured. An impregnation material development and a design optimization study are described. Life tests were performed under combined high temperature and radiation conditions. Vibration and shock tests were also combined with high temperature (500°C). (W.D.M.)

21645

ELECTRICAL RESISTIVITY RECOVERY IN COLD-WORKED AND ELECTRON-IRRADIATED NICKEL. A. Sosin and J. A. Brinkman (Atomics International Div., North American Aviation Inc., Canoga Park, Calif.). Acta Met. 7, 478-94(1959) July.

Pure nickel wires were subjected to electron irradiation and cold work. Electrical resistivity recovery, starting at room temperature and extending to the recrystallization range, was studied. Recovery stages near 100°C (Stage III) and 270°C (Stage IV) were found to occur by a diffusion process following cold work; dislocations are believed to be the defect sinks. Stage III was found to obey a second-order chemical rate equation following irradiation; Stage IV is essentially absent. An activation energy for defect migration of about 1.05 ev was found in Stage III following both irradiation and cold work; the energy associated with defect migration in Stage IV is not as well determined. These measurements on nickel indicate that the defect migrating in Stage III is an interstitial atom in Stage IV, a vacancy. The close similarity between the recovery in nickel and that in copper suggests a similar assignment in copper. (auth)

21646

THE EFFECT OF IONIZING RADIATIONS ON THE STRUCTURE OF POLYAMIDES. N. A. Slovokhotova (Karpov Scientific Research Inst. of Physics and Chemistry). Doklady Akad. Nauk S.S.S.R. 127, 831-4 (1959) Aug. 1. (In Russian)

Infrared spectroscopy was used in studies of the effects of ionizing radiation on the polyamide structure. The irradiation was carried out in a vacuum with accelerated electrons (the acceleration field intensity was

200 kv, the current density was 2.2 $\mu a/cm^2$) and γ radiation from Co^{60}. Irradiation induces alterations in the number of methylene groups in methylene chains, breaks intermolecular hydrogen bonds, and simultaneously forms other intermolecular hydrogen bonds. In irradiation as in melting, polyamides pass into an amorphous state. (R.V.J.)

21647

THE CLIMATIC FACTOR IN THE RADIOCARBON CONTENT OF WOODS. W. W. Whitaker, S. Valastro, Jr., and Milton Williams (Humble Oil and Refining Co., Houston, Tex.). J. Geophys. Research 64, 1023-9(1959) Aug.

Past research has shown significant variations in radiocarbon contents of woods from different environments and in the degrees to which these radiocarbon contents reflect dilution of atmospheric carbon dioxide by carbon dioxide from fossil fuels. An attempt is made to relate these variations to climatic factors. Comparison of radiocarbon contents of individual tree rings with thicknesses of the rings and, in some cases, with meteorological records suggests that the radiocarbon contents of rings produced in years of heavy rainfall may be relatively low and that the contents of rings added in times of drought may be comparatively high. The year-to-year fluctuations in radiocarbon content observed in individual trees probably cannot be ascribed to rainfall alone, but likely also depend upon other factors. The apparent dependence of radiocarbon content on climate seems to be a result of a varying contribution to the tree of carbon from the pedosphere. (auth)

21648

MEASURING STORED ENERGY IN IRRADIATED GRAPHITE. Nuclear Power 4, No. 40, 94(1959) Aug.

The kinetics, though incomplete, involved in measuring the stored energy in irradiated graphite by means of a calorimeter are discussed. (C.J.G.)

RADIOACTIVE WASTE

21649 HW-56001

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INTERIM REPORT ON TESTS PERFORMED AT THE K REACTORS TO EFFECTIVELY DECONTAMINATE THE PROCESS PIPING BY AN INTERNAL CHEMICAL FLUSH. H. F. Jensen. May 22, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The chemical flush resulted in corrosion of the Al at the rate of 0.04 mils in five minutes using a Turco 4360-B concentration of 3 ounces per gallon at 50°C. Tests indicate that laboratory procedures are inadequate for heavy contamination found in process tubes, however, increasing the Turco concentration and contact time appear to provide satisfactory results. Further tests aimed at optimizing tube decontamination are scheduled. Experimental results are presented graphically and tabularly. (J.R.D.)

21650 HW-61476

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FIELD EXPERIMENTS WITH MODEL CRIB. I. LOCATION, FACILITY DESIGN AND FIRST EXPERIMENT. K. C. Knoll and J. L. Nelson. Aug. 4, 1959. 15p. Contract AT(45-1)-1350. $3.30(ph), $2.40(mf) OTS.

Methods for predicting the capacity of a crib for the retention of wastes were studied. Nine thousand gallons of a $Ca(NO_3)_2$ solution with a concentration of 600 ppm Ca and traced with Sr^{85} were discharged into the ground by means of a square foot crib. The ground water underneath the crib was monitored for NO_3^- and Sr^{85} ions. The amount of solution which was discharged to the crib up to the time that a breakthrough of the nitrate ion was first found was four times the volume of the column of soil having the cross section of the crib and extending to ground water. Strontium-85 was retained by the soil until an amount of solution equivalent to 20 times the column volume had been discharged to ground. (W.L.H.)

21651

PHYSICAL AND CHEMICAL PROPERTIES OF NUCLEAR POWER REACTOR WASTE SOLUTIONS. W. J. Lacy (Office of Civil Defense Mobilization, Battle Creek, Mich.) and F. M. Empson, and I. R. Higgins (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 51, No. 10, 83A-6A(1959) Oct.

Approximate waste concentrations presented are typical of waste produced by Purex, TBP-25, STR, Darex, and SIR processes with fuels of current design. Evaporation of acidic waste provides the maximum reduction in volume to be secured by a simple treatment. Controlled heating of the dry residues further reduces the mass of the solid residue. Neutralization of the acidic wastes produces solid precipitates (ferric, aluminum, or zirconium hydroxide) which settle slowly and are difficult to filter; calcium hydroxide gave precipitates which filter more readily than sodium hydroxide-neutralized material. A flocculating agent improves settling rates, more for the calcium hydroxide neutralized material than for the sodium hydroxide-neutralized. If neutralization is desirable before evaporation, the neutralized waste can be satisfactorily evaporated in a system which prevents bumping. (auth)

21652

AMP—EFFECTIVE ION EXCHANGER FOR TREATING FISSION WASTE. J. Van R. Smit, W. Robb, and J. J. Jacobs (National Chemical Research Lab., Pretoria). Nucleonics 17, No. 9, 116, 118, 120-3(1959) Sept.

The feasibility of separating Cs^{137} from fission-product solutions by means of ammonium phosphomolybdate (AMP) was demonstrated by experiments. The behavior of Zr^{95} and Nb^{95} when present in solutions as cations is discussed. The possibility of treating neutral fission-products solutions with columns of AMP is investigated. The advantages and disadvantages of AMP are presented. (C.J.G.)

21653

USE OF SILICATES IN THE REFINING OF HIGHLY ACTIVE WASTES. J. Beranek and K. Lustig. Sklář a keram. 8, 102-6(1958). (Translated from Referat. Zhur. Khim. No. 24, 1958, Abstract No. 82338.)

A study of possibilities of radioactive isotopes conversion from the liquid into the solid phase is presented. Stability of the inorganic ion exchange materials (mainly morillonites and bentonites) is such that upon calcination, an irriversible fixation of cations occurs. Such products, when saturated with the radioactive ions, are not subject to decomposition and may be safely stored. However, the clays have low exchange capacities (not greater than 100 mg/equiv for 100 g of ionite), and they do not adsorb ruthenium. A great portion of the processed solutions contain considerable

concentrations of HNO_3, that destroys the structure of clays and lowers their ion exchange characteristics. The inorganic ion exchange materials may be employed in those cases when it is necessary to decontaminate the already separated isotopes of Cs and Sr, or to utilize ionites, saturated with radioactive isotopes as the source of irradiation. Laboratory and pilot plant work indicated the possibility of effective utilization of silicates for the fixation of active material. The method consists in the mixing of active wastes with the silicates followed by drying and calcining. (auth)

21654

CERTAIN METHODS OF DECONTAMINATION OF HIGHLY ACTIVE EFFLUENTS. T. Jaeger. Technik (Berlin) 13, 41-7(1958). (Translated from Referat. Zhur. Khim. No. 24, 1958, Abstract No. 82226.)

Characteristic composition of the highly active effluents from nuclear reactors are examined. Allowable concentration of the radioactive isotopes in water, biological cycles of P^{32}, and of other isotopes are listed. Descriptions of various disposal methods as applied to effluents including dumping of solutions into the ocean, marine disposal of closed containers containing these effluents, and disposal into deep drilled wells are given. The accumulation of highly active liquids in the underground storages, concentration of active solutions for the purpose of obtaining salt mixtures, utilization of the ion exchange, the melting with aluminum silicates, and conversion into ceramic materials are also discussed. (auth)

21655

HEARINGS ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL, JANUARY 28, 29, AND 30; FEBRUARY 2 AND 3, 1959. VOLUME 1. Washington, D. C., Joint Committee on Atomic Energy, 1959. 991p. $3.00(GPO).

The origin and nature of various types of radioactive wastes from nuclear energy activities are considered, and the management of these wastes at various Atomic Energy Commission and other installations is discussed. Separate abstracts have been prepared for each paper. (C.J.G.)

21656

NATURE OF WASTES FROM THE URANIUM MILLING INDUSTRY. p.58-71 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The liquid wastes generated by the uranium milling industry have been determined to be sources of chemical and radioactive pollutants. The chemical species may include iron and manganese, sulfate, nitrate, magnesium, uranium, chloride, and dissolved solids. The radioactive isotopes in uranium mill tailings include natural uranium, thorium-234, thorium-230, and radium-226. The specific pollutants depend upon the particular flowsheet considered. The severity of the pollution problem depends upon the size, quality, and ultimate usage of the receiving waters, while the legal aspects depend upon the specific state laws involved. (auth)

21657

THE NATURE OF WASTES PRODUCED IN THE MINING AND MILLING OF URANIUM ORES. Duncan A. Holaday (U. S. Dept. of Health, Education, and Welfare, Salt Lake City). p.72-84 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Uranium mining and processing involves the handling and disposal of a large number of waste products. These materials are composed of solids, liquids, and gases, some of which are common to many industries, and some radioactive elements which are peculiar to this one. In mining, the most significant materials of hygienic importance are radon and its daughters and silica dust. These elements are potentially hazardous to the health of the miners, and exposure to them must be controlled. A variety of toxic materials is handled or produced in milling operations, which require control to prevent health damage to the workers. The effluents from the mills contain chemical and radioactive wastes which can present water and air pollution problems. (auth)

21658

URANIUM MILL WASTES. William N. Gahr (Colorado State Dept. of Public Health). p. 85-94 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The contamination of river water by radioactive waste from uranium mills is discussed. The radioactivity of river waters in Colorado is given. (C.J.G.)

21659

WASTE CHARACTERISTICS FOR THE RESIN-IN-PULP URANIUM EXTRACTION PROCESSES. E. C. Tsivoglou, D. C. Kalda, and J. R. Dearwater (Robert A. Taft Sanitary Engineering Center, Cincinnati). p.95-115 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

For the ore that was being processed at the uranium refinery under study, about 17% of the gross alpha activity of the ore was due to the presence of radium. At the ore processing rate of 517 tons per day, the liquid and solid wastes from ore processing contained about 0.6 milligrams of radium per ton of ore processed, or a total of approximately 300 milligrams per day. By far the bulk of this radium, or some 99.8%, remained in undissolved form throughout the process, and was effectively retained in the sands and slimes tailings ponds. About 0.2% of the radium that entered the mill with the ore either left the refinery in the final uranium concentrate or was delivered in dissolved form to the slimes or sands pond. Specifically, it is estimated that some 310 μg/day of dissolved radium went to the slimes pond, about 60 μg/day went to the sands pond, and about 150 μg/day left the mill in dried yellowcake. The radium content of the dried sands was about 150 micromicrograms per gram of sands, while the radium content of dried slimes solids was 2,500 or more micromicrograms per gram. Sands accumulation was in the neighborhood of 440 tons per day, while slimes accumulated at a rate of about 80 tons per day. Effective retention and confinement of these solids and of the tailings pond liquids resulted in practically no radium leaving the plant site during the survey, except for that contained in the uranium concentrate that was drummed and shipped. Slime neutralization before discharge to the tailings pond reduced the dissolved radium concentration from 2,450 to 350 $\mu\mu$g/l, or by about 85%. Liquid from the slimes pond showed a comparable concentration of about 270 $\mu\mu$g/l of dissolved radium. Based on the data, about one-third of the dissolved gross alpha activity in the slimes pond liquid was due to radium, at the mill studied. (auth)

21660

NATURE OF WASTES IN FUEL ELEMENT MANUFACTURE. N. C. Jessen (Babcock and Wilcox Co., Lynchburg, Va.). p.116-21 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Waste that cannot be economically processed for U recovery and methods for its disposal are discussed. (C.J.G.)

21661

RADIOACTIVE WASTES FROM REACTOR OPERATION. p.122-34 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Radioactive wastes from reactor operation are produced by fission of the fuel and neutron activation of the coolant, coolant impurities, and structural components. The degree to which both types of wastes are produced and controlled varies with reactor classification, fuel, coolant, and moderator. Waste production is cited for specific reactors of both heterogeneous and homogeneous types. (C.J.G.)

21662

NATURE OF RADIOACTIVE WASTES GENERATED BY PROCESSING SPENT REACTOR FUEL AT THE IDAHO CHEMICAL PROCESSING PLANT. p.135-9 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Spent fuel from reactors is dissolved in acid, and usable fissionable material is recovered by a three-stage liquid-liquid extraction process. The remaining solutions, containing fission products and dissolved metals, are highly radioactive (1500 c/gal) and must be stored. 750,000 gallons of such waste have been placed in storage. The chemical compositions, isotopic compositions, and activities of the solutions are tabulated. (C.J.G.)

21663

NATURE OF WASTE FROM RADIOISOTOPE USES. Lester R. Rogers (U. S. Atomic Energy Commission, Oak Ridge, Tenn.). p.140-59 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The Commission's primary radioisotope supplier, ORNL, ships active isotopes to 4400 institutions in the U. S. for use in medicine, industry, agriculture, and research. These shipments represent 437,000 curies of radioactivity. At this rate, it is estimated that 100 to 200 curies of waste with a half life greater than 30 days and 400 to 500 curies with a half life less than 30 days are being generated. This amount of waste is exceedingly small when compared with that from the national nuclear energy program. (D.E.B.)

21664

RADIOACTIVE WASTE MANAGEMENT OPERATIONS AT THE HANFORD PLANT. H. M. Parker (General Electric Co., Richland, Wash.). p.171-98 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The radioactive waste generated from the principle operations of the plant is enumerated. Management of the waste products is discussed. (C.J.G.)

21665

RADIOACTIVE WASTE MANAGEMENT OPERATIONS AT THE HANFORD WORKS. PART 1. HANFORD RADIOACTIVE WASTE MANAGEMENT. H. M. Parker (General Electric Co., Richland, Wash.). p.199-241 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Fuel preparation, reactor, and chemical separation operations are reviewed to show waste sources. Treatment and containment methods for radioactive waste arising from operations are discussed. Radiation protection standards, safety hazards, and the waste disposal policy are given. The magnitudes of radioactivity in waste products at various points in the operation and disposal processes are given. (C.J.G.)

21666

RADIOACTIVE WASTE MANAGEMENT OPERATIONS AT THE HANFORD WORKS. PART 2. RELEASE OF REACTOR COOLING WATER TO THE COLUMBIA RIVER. R. F. Foster (General Electric Co., Richland, Wash.). p.242-69 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Water purification and treatment of water downstream from the Hanford Production Reactors are described. The origin of reactor effluents, management of the waste disposal, and waste monitoring in the river are discussed. Field studies indicate the fish and waterfowl are to no degree affected by the effluents. An evaluation of the control of exposure associated with radioactive wastes from the Hanford Plants is given. (C.J.G.)

21667

RADIOACTIVE WASTE MANAGEMENT OPERATIONS AT THE HANFORD WORKS. PART 3. RELEASE OF GASES, VAPORS, AND PARTICLES TO THE ATMOSPHERE. R. E. Tomlinson (General Electric Co., Richland, Wash.). p.270-81 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Operation, maintenance, and safety hazards of existing processing systems and controls for atmospheric disposal of radioactive wastes at the Hanford Plant are discussed. Radiation monitoring at various points is explained. (C.J.G.)

21668

RADIOACTIVE WASTE MANAGEMENT OPERATIONS AT THE HANFORD WORKS. PART 4. STORAGE OF HIGH-LEVEL FISSION PRODUCT WASTES. R. E. Tomlinson (General Electric Co., Richland, Wash.). p.282-307 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The technology involved in the storage of fission products from the Hanford Production Reactors is discussed with particular emphasis on safety. (C.J.G.)

21669

RADIOACTIVE WASTE MANAGEMENT OPERATIONS AT THE HANFORD WORKS. PART 5. DISPOSAL OF INTERMEDIATE AND LOW-LEVEL WASTES TO THE GROUND. D. W. Pearce (General Electric Co., Richland, Wash.). p.308-18 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Intermediate and low-level waste from Hanford is disposed to swamps, cribs, and trenches. To ensure containment of the radioisotopes on the soil column, various waste streams from the plant are kept separate. Standards on the disposal of radioactive liquids are given. (C.J.G.)

21670

BIBLIOGRAPHY OF SELECTED HANFORD LITERATURE ON RADIOACTIVE WASTE DISPOSAL. p.339-70 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Radiation protection standards pertaining to waste disposal practices are appended. (D.E.B.)

21671

STATEMENT OF K. Z. MORGAN, DIRECTOR OF THE HEALTH PHYSICS DIVISION, OAK RIDGE NATIONAL LABORATORY. p.428-60 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

A discussion is given of the waste management facilities and the effectiveness of these facilities. (C.J.G.)

21672

STATEMENT ON WASTE MANAGEMENT AT THE OAK RIDGE AND PADUCAH PRODUCTION PLANTS. Logan B. Emlet (Union Carbide Nuclear Co., Oak Ridge, Tenn.). p.515-26 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The manner in which radioactive waste management problems are handled is described. The radioactive waste discussed is comprised of contaminated material containing small quantities of uranium, for which the cost of recovery would exceed the value of the material obtained, and production toils. (C.J.G.)

21673

STATEMENT OF PHILLIPS PETROLEUM CO. AS OPERATOR OF THESE FACILITIES UNDER CONTRACT WITH THE ATOMIC ENERGY COMMISSION RE WASTE MANAGEMENT OPERATIONS PROGRAM ON THE COLLECTION, HANDLING, PROCESSING AND DISPOSAL OF WASTE MATERIALS AT THE IDAHO CHEMICAL PROCESSING PLANT, MATERIALS TESTING REACTOR AND ENGINEERING TEST REACTOR. p.610-14 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Liquid, solid, and gaseous waste processing programs for the Idaho Chemical Processing Plant, the Materials Testing Reactor, and the Engineering Test Reactor are presented. (C.J.G.)

21674

PRESENTATION ON SHIPPINGPORT ATOMIC POWER STATION (PWR) WASTE DISPOSAL FACILITIES. A. L. Bethel, J. R. LaPointe, and W. J. Hahn (Westinghouse Electric Corp., Bettis Atomic Power Div., Pittsburgh). p.620-64 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Criteria and controls required for satisfactory waste disposal are discussed. A description of the waste treatment process is presented. (C.J.G.)

21675

INDUSTRIAL RADIOACTIVE WASTES: MINING AND MILLING OF URANIUM ORES. p.674-87 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Waste products of uranium mines consist of ventilation air, waste rock, and water if the mine is wet. Radioactivity of these wastes generally has been found to be of such a low order that no radioactive waste disposal problem is considered to exist. Within the mine proper the emanation of radon gas requires special considerations which are discussed. Uranium ore processing mills are confronted with the problem of disposing of radioactive liquid and solid residues. Waste management operations of the uranium ore processing industry are discussed for various processing plants. (C.J.G.)

21676

WASTE MANAGEMENT OPERATIONS AT THE FEED MATERIALS PRODUCTION CENTER. R. C. Heatherton and K. N. Ross (National Lead Co. of Ohio, Fernald). p.688-701 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Waste treatment and storage facilities of the plant are discussed. Waste processing flow diagrams are presented. Water survey methods, waste disposal data for the past five-year period, and cost of disposal facilities are contained. (C.J.G.)

21677

STATEMENT OF TRACERLAB, INC., ON WASTE MANAGEMENT OPERATIONS. Samuel S. Auchincloss (Tracerlab, Inc., [Richmond, Calif.]). p.702-7 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Disposal procedures for solid and liquid wastes are discussed in relation to cost and safety. (C.J.G.)

21678

MANAGEMENT OF RADIOACTIVE WASTE AT ARGONNE NATIONAL LABORATORY. p.708-43 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The radioactive waste disposal system is described. No wastes are stored permanently on the site and all fluid wastes are reduced to solids to be shipped offsite. Cost and safety measures of the system are explained. (C.J.G.)

21679

WASTE MANAGEMENT OPERATIONS AT BROOKHAVEN NATIONAL LABORATORY. F. P. Cowan and L. Gemmell. p.744-67 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

A flow diagram is presented which illustrates the major features and interrelationships of the waste control system. Gaseous, liquid, and solid wastes are discussed separately. Methods of processing solid wastes for local and sea disposal are covered. (C.J.G.)

21680

RADIOACTIVE WASTE MANAGEMENT AT THE KNOLLS ATOMIC POWER LABORATORY. p.768-811 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Waste processing and disposal methods for solids, liquids, and gases are given. Facilities and procedures used in conjunction with waste disposal are discussed. Annual operating costs for 1958 are presented. A description of radiation monitoring in all phases of the waste disposal program is presented. (C.J.G.)

21681

RADIOACTIVE WASTE DISPOSAL PRACTICES AT LOS ALAMOS. C. W. Christenson. p.812-25 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The methods of control and containment of radioactive wastes are taken up in the order of solids, liquids, and airborne wastes. (C.J.G.)

21682

WASTE MANAGEMENT SAVANNAH RIVER PLANT ATOMIC ENERGY COMMISSION. Robert J. Christl (E. I. Du Pont De Nemours and Co., Aiken, S. C.). p.826-41 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Physical handling and disposition of radioactive wastes are presented relative to monitoring and economic aspects. (C.J.G.)

21683

RADIOACTIVE WASTE DISPOSAL AT LAWRENCE RADIATION LABORATORY. Nelson B. Garden (Univ. of California, Berkeley). p.842-3 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Radioactive waste disposal problems in handling, processing, and storage are presented. (C.J.G.)

21684

WASTE MANAGEMENT AT THE APPR-1. p.876-89 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The Army Package Power Reactor I has operated successfully for 20 months. An environmental monitoring program has been in effect since the pre-construction period to ensure that there is no increase in radioactivity in the area. Effluent monitors provide a control for the discharge of gaseous wastes to the atmosphere and liquid wastes to the Potomac River. All gaseous wastes to date have been vented to the atmosphere. Liquids, the greatest contributor to the radioactive wastes, have been collected and discharged safely to the river. Solid wastes are accumulated irregularly and are disposed of by approved methods. (auth)

21685

RADIOACTIVE WASTES AT THE CONVAIR-FORT WORTH PLANT. B. P. Leonard and F. L. Paschal (Convair, Fort Worth, Tex.). p.890-99 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

Waste disposal of gases, liquids, and various activated materials is discussed. Aircraft flying at high altitudes have become contaminated to some extent by radioactive bomb debris in the atmosphere. Wastes arising from decontamination of the aircraft are enumerated and disposal techniques are given. (C.J.G.)

21686

RADIOACTIVE WASTE DISPOSAL AT THE BETTIS PLANT. p.900-23 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

All of the liquid, solids, and airborne radioactive wastes, generated at the Bettis Plant, are collected, monitored, processed, and disposed of in accordance with prescribed limits and procedures. If the concentration of radioactivity in the liquid is below specified limits, the water is dumped to the storm sewer and is discharged with the other water effluent from the plant. Waste which exceeds specified limits of radioactivity is processed. Processing consists of concentration, filtration, or ion-exchange. The radiation intensity of solids varies between a fraction of a mr per hour on surface-contaminated solids to several hundred r per hour. All solid radioactive wastes can be classified as combustibles or non-combustibles. Radioactive combustibles are reduced to ash in a specially designed incinerator and sent to sea for burial. Radioactive non-combustible wastes are sealed in concrete inside 55-gallon drums and sent to the ocean for burial. The discharge of air which might contain radioactive dusts, fumes, and mists from plant processes is carefully controlled. Wet collectors, electrostatic precipitators, high efficiency filters, and various dry filter media are used to remove the radioactive particulates from the air before it is discharged to the atmosphere. Discharges of air are sampled on a routine basis. (auth)

21687

RADIOACTIVE WASTE DISPOSAL FROM U. S. NAVAL NUCLEAR POWERED SHIPS. T. J. Iltis and M. E. Miles (Bureau of Ship, Washington, D. C.). p.924-57 of "Hearings on Industrial Radioactive Waste Disposal. Volume 1."

The sources and nature of radioactive wastes from U. S. Naval nuclear powered ships are described, the established waste disposal procedures used are outlined, and the measurements made to detect any effect of wastes discharged on the radioactivity of their harbor environs are summarized. The basic criterion adopted for disposal of radioactive waste from Navy ships is that disposal should not increase the average concentration of radionuclides in the surrounding environment by more than one-tenth of the maximum permissible concentrations for continuous exposure listed in National Bureau of Standards Handbook 52. Actual data from the operating ships show that the radioactivity of their wastes is consistently low and has had no detectable effect on the radioactivity of their environment. (auth)

21688

HEARINGS ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL, JANUARY 28, 29, AND 30; FEBRUARY 2 AND 3, 1959. VOLUME 2. Washington, D. C., Joint Committee on Atomic Energy, 1959. p.987-1823. $2.25 (GPO).

Reports are included on the treatment and controlled dispersal of low and intermediate level wastes to the atmosphere, surface waterways, the ground, and the ocean. Environmental investigations associated with the development program are also discussed. (C.J.G.)

21689

DISPOSAL OF LOW LEVEL LIQUID RADIOACTIVE WASTES IN SURFACE WATERWAYS. Harold A. Thomas, Jr. and Gordon McKay (Harvard Univ., Cambridge, Mass.). p.1005-9 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Radioactive liquid waste disposal to surface waterways is discussed relative to safety, economics, dispersal, and ultimate fate. (C.J.G.)

21690

RESEARCH AND DEVELOPMENT PROGRAMS RELATED TO THE DISPOSAL OF REACTOR EFFLUENT TO THE COLUMBIA RIVER. Richard F. Foster (General Electric Co., Richland, Wash.). p.1018-47 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Research and development work at Hanford has produced a sufficient amount of information on the expected time, place, and concentration of reactor effluent isotopes in Columbia River water and in plants and animals to provide assurance that effluent disposal practices are reasonable and justified. These studies were accompanied by investigation of related problems which include determination of the nature and degree of exposure associated with each water use, development of precision methods for quickly identifying and measuring the concentrations of significant radioisotopes, inquiry into the sources and production of radioisotopes which appear in the effluent, and evaluation of the efficacy of existing or proposed effluent handling methods. Biological studies have also provided information on

the mechanisms by which various plants and animals pick up the radioactive materials, where the isotopes are deposited, and metabolic characteristics bearing on the validity of the recommended maximum permissible concentrations. (auth)

21691

RADIOACTIVE WASTE DISPOSAL TO SURFACE WATERS. E. C. Tsivoglou (Robert A. Taft Sanitary Engineering Center, Cincinnati). p.1048-73 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Activities of the Public Health Service directed toward the control of radioactive contamination of surface waters are briefly reviewed. Findings from investigations conducted in the vicinities of major AEC sites are discussed. (D.E.B.)

21692

WASTE DISPOSAL RESEARCH AND DEVELOPMENT IN THE URANIUM MILLING INDUSTRY. p.1074-81 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Laboratory data to date have indicated that both acid and alkaline tailings may be decontaminated by a neutralization-barite adsorption process. To meet stringent specifications, it may be necessary to add a costly amount of chemical reagents or go to relatively complex contacting schemes for applying the process. At the present time, further laboratory experiments are in progress to refine the basic process. Along with developing at least some of the fundamental process data for handling the problem, it was necessary to develop methods for detecting and quantitatively determining the radioactive isotopes. Methods for determining uranium, radium-226, thorium-234, thorium-230, and polonium-210 are now available to the mill operators. Surveys of typical mills are being made in order to trace the flow of radium through the process in an effort to determine the effect of the uranium treatment process on the dissolution and ultimate disposition of radium. (auth)

21693

REMOVAL OF RADIOACTIVE CONTAMINATION FROM PUBLIC WATER SUPPLIES. Rolf Eliassen (Massachusetts Inst. of Tech., Cambridge). p.1082-92 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Laboratory research was conducted on waters containing such radioactive and stable isotopes as strontium, yttrium, iodine, phosphorus, cobalt, and ruthenium. This research was followed by field studies on actual water filtration plants having surface water sources contaminated with small amounts of radioactive fallout during and following the nuclear weapons testing program held in Nevada in early 1955. Results of the laboratory research and field studies are given. (C.J.G.)

21694

DISPOSAL OF RADIOACTIVE LIQUID WASTES TO THE GROUND AT HANFORD. D. W. Pearce (General Electric Co., Richland, Wash.). p.1124-71 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Low level liquid waste disposal to the ground at Hanford has been supported between a closely correlated and balanced program of theoretical study, laboratory and field experiment, and observational experience. Extensive effort in geology and hydrology, mineralogy and soil chemistry, analytical chemistry, and engineering has been applied to ground disposal problems. The more important findings from the research and development in each of these areas are outlined to show how this applies to plant practice, and indicate in general the future course of the work. (auth)

21695

EXPERIENCE IN THE DISPOSAL OF RADIOACTIVE WASTES TO THE GROUND. R. E. Brown and D. W. Pearce (General Electric Co., Richland, Wash.); W. de Laguna and E. G. Struxness (Oak Ridge National Lab., Tenn.); and J. H. Horton, Jr. and C. M. Patterson (E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.). p.1205-17 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Disposal of low level liquid radioactive wastes to the ground at the Hanford Works, Washington, the Oak Ridge National Laboratory, Tennessee, and the Savannah River Plant, South Carolina, is founded on the ability of various earth materials to remove and retain fission product cations. Twelve years of practical experience in the controlled disposal of wastes to the ground at the Hanford Works, seven years at the Oak Ridge National Laboratory, and four at the Savannah River Plant, have demonstrated the feasibility, safety, and economy in the disposal of at least limited volumes of some types of liquid wastes at shallow depths. Some of the experience which indicates the potential of this disposal method and the problems involved are described. (auth)

21696

AN INVESTIGATION OF THE DISPOSAL OF RADIOACTIVE WASTES INTO DEEP GEOLOGIC FORMATIONS. p.1218-26 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

The injection of radioactive wastes into deep geologic formations is considered a feasible and economic approach to handling low and intermediate level wastes. Deep injection does not represent a panacea for all nuclear wastes, but rather is one possible solution to be arrived at only after considering the factors peculiar to a given situation. The basic research and development associated with deep well injection has been underway for several years and has reached the point where a full scale field test is indicated. The chemical treatment of low and intermediate level wastes will be necessary to make them compatible with the receiving formation. If the wastes at a site vary widely in chemical composition, holdup, blending, and testing may be necessary prior to chemical treatment and injection. It is almost certain that the preinjection treatment operation should include filtration and pH adjustment. Field measurements of the dispersion properties of the formation, will make possible a completely engineered disposal system, the useful formation capacity, and hence the unit cost of the injection phases of the operation, should be a calculable quantity. (auth)

21697

UNDERGROUND MOVEMENT OF RADIOACTIVE WASTES. R. G. Orcutt, M. N. E. Rifai, G. Klein, and W. J. Kaufman (Univ. of California, Berkeley). p.1227-53 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Several theories are presented for describing quantitatively hydraulic dispersion, ion-exchange equilibria, and ion-exchange kinetics as they apply to the movement of radioisotopes through natural porous media. Laboratory studies were conducted with radiostrontium and several natural exchangers to determine

the applicability and limitations of these theories. The laboratory results do not conclusively establish that the maximum rate of strontium movement can be readily predicted under all circumstances. However, it is believed that the theories of dispersion and ion-exchange, when used in conjunction with field-scale tests, will serve to reduce greatly the uncertainties of ground disposal operations. The salient experimental results are summarized. (auth)

21698

ENVIRONMENTAL FACTORS AFFECTING THE DISPOSAL OF RADIOACTIVE WASTE MATERIALS INTO TIDAL ESTUARIES AND COASTAL BODIES OF WATER. D. W. Pritchard (Johns Hopkins Univ., Baltimore). p.1278-98 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

The environmental factors which will affect the disposal of various forms of radioactive wastes into the marine environment are discussed with particular emphasis on harbors, estuaries, and coastal waters. Not only is purposeful introduction of radioactive materials into such environments discussed but also accidental introduction which might result from an unforeseen catastrophe to a shore based reactor, or from a collision involving a nuclear powered ship. The fate of such wastes, with emphasis on possible return routes to man, is considered. This information can be utilized in evaluating the risks to man from disposal of radioactive wastes in the marine environment as compared to the costs and risks which might result from other methods of disposal. (C.J.G.)

21699

RESEARCH NEEDED TO EVALUATE THE EFFECTS OF RADIOACTIVE MATERIAL IN THE MARINE ENVIRONMENT. Roger Revelle (Scripps Institution of Oceanography, La Jolla, Calif.). p.1299-1323 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

A research program is presented for evaluating the effects of radioactive material in the marine environment. Present knowledge on coastal and estuarine environments is reviewed. Specific field tests under present study and future tests to be undertaken are explained. Estimates of annual cost for various areas of the program are given. (C.J.G.)

21700

OCEANOGRAPHY 1960 TO 1970—A REPORT OF THE COMMITTEE ON OCEANOGRAPHY OF THE NATIONAL ACADEMY OF SCIENCES (FEBRUARY 1959). CHAPTER 1. INTRODUCTION AND SUMMARY OF RECOMMENDATIONS OF THE COMMITTEE ON OCEANOGRAPHY, NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL. Harrison Brown (California Inst. of Tech., Pasadena). p.1324-65 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Recommendations are made for the advancement in oceanographic studies, including educational aid in the form of fellowships, equipment, and professor salaries. A discussion on construction, size, cost, operation equipment contained, and type of ships to be used in oceanographic studies is presented. Capital and operating costs are tabulated, and proposals are made for financing the program. (C.J.G.)

21701

THE DISPOSAL OF RADIOACTIVE WASTES INTO THE ATLANTIC AND GULF OF MEXICO COASTAL WATERS OF THE UNITED STATES. p.1428-88 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

A study was made of the feasibility of using selected areas in the Atlantic and Gulf of Mexico coastal waters as receiving grounds for the disposal of packaged, low-level, radioactive wastes. The limiting rate of disposal was taken as that which through a combination of physical and biological processes will return the radioactivity to man at a rate equal to the maximum permissible rate of ingestion of a given radionuclide in drinking water. The present practice of using 55 gal steel drums as disposal canisters containing the waste mixed with concrete is estimated to provide containment of approximately 10 years, during which time radioactive decay will have destroyed all radioisotopes to below hazardous levels, with the exception of Sr^{90}, Cs^{137}, and possibly Co^{60}. Coastal circulation is not known in sufficient detail to provide quantitative estimates of the rate of transport of a contaminant out of any of the areas selected as possible disposal sites. Several areas stand out as being probably unsuited as disposal sites. They are the coastal estuaries and bays, and the regions immediately seaward of these areas. Shoreward transport along the bottom in these regions would tend to intensify the rate of return of a contaminant to man. A theoretical study of the dilution of contaminant by turbulent mixing processes was made. The results of the study provide the means of evaluating the effects of changing environmental parameters and of various disposal methods on the dilution of a contaminant. In arriving at recommended disposal rates the interaction of a contaminant with suspended solids and bottom sediments was neglected. An estimate was made of the maximum permissible concentration of each of several radioisotopes in sea water, below which contamination of marine food products will not lead to greater than allowable intake for humans whose sole source of protein is fish. Suggested disposal areas were chosen in an attempt to minimize conflict with submarine cable operation, as well as the purely mechanical problems connected with fisheries activities. (auth)

21702

CONSIDERATIONS ON THE DISPOSAL OF RADIOACTIVE WASTES FROM NUCLEAR POWERED SHIPS INTO THE MARINE ENVIRONMENT. p.1489-1527 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

An evaluation of the nature and amount of radioactive waste materials which would conceivably be introduced into the sea through normal operations of nuclear-powered ships is given. No conclusions are reached concerning the safety of operating nuclear-powered ships in tideless, fresh water bodies. Routes by which such introduced activity would return to man from the sea are given. The portion of the maximum permissible dose to man, allotted to the peaceful uses of nuclear energy, which should be permitted to originate from waste disposal operations from nuclear-powered ships is evaluated. The concentration by marine organisms of the various significant isotopes in the wastes, and the processes of dispersion of the wastes within the various subdivisions of the marine environment are discussed. The permissible rate of introduction of the subject waste materials into the various subdivisions of the marine environment is evaluated. Wastes which would originate from a water-cooled reactor are specifically treated. (auth)

21703
STATEMENT OF DONALD H. PACK, METEOROLOGIST, DEPARTMENT OF COMMERCE, WEATHER BUREAU. p.1535-78 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Plant site and weather conditions due to various factors are discussed in relation to radioactive waste disposal to the atmosphere. (C.J.G.)

21704
STATEMENT OF LESLIE SILVERMAN, SC. D., PROFESSOR OF ENGINEERING IN ENVIRONMENTAL HYGIENE, DIRECTOR OF RADIOLOGICAL HYGIENE PROGRAM, HARVARD UNIVERSITY. p.1629-49 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

Various types of air and gas cleaning apparatus are described. Economic aspects and shortcomings of each apparatus are given. (C.J.G.)

21705
AIR CLEANING STUDIES. Leslie Silverman (Harvard Univ., Cambridge, Mass.). p.1650-59 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

A discussion is given of air cleaning problems with reference to methods for removal of iodine from air, inexpensive devices for incinerating solid waste, economic feasibility of air and gas cleaning, and the development of filtration devices. (C.J.G.)

21706
SUMMARY OF RESEARCH AND DEVELOPMENT WORK CONDUCTED FOR THE U. S. ATOMIC ENERGY COMMISSION. Department of Sanitary Engineering and Water Resources, Johns Hopkins Univ., Baltimore. p.1673-1723 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

A summary of research and development work for the United States Atomic Energy Commission on contamination by radioisotopes, disposal practices of atomic energy installations, methods for the fixation of radioisotopes on or in solid media, and sites for future radioactive waste disposal is presented. (C.J.G.)

21707
AN OPERATIONS RESEARCH STUDY OF THE TRANSPORTATION OF HIGHLY RADIOACTIVE MATERIALS. PROGRESS REPORT, APRIL 1959. J. T. Thompson and F. F. Leimkuhler (Johns Hopkins Univ., Baltimore). p.1724-87 of "Hearings on Industrial Radioactive Waste Disposal. Volume 2."

The transportation of highly radioactive materials is treated as an operations research problem of selecting that combination of controllable transportation factors which minimizes cost and maximizes safety. Maximum safety is equated with minimum expected hazard cost, which makes it possible to construct decision models in terms of a total transportation cost, including the expected hazard cost. A detailed analysis is made of the significant factors in the transportation problem; and various methods of evaluating transportation hazards are examined. Examples and applications of the decision models are presented in considerable detail. (auth)

REACTORS

General

21708 AECU-4325
Oak Ridge National Lab., Tenn.
THE DESIGN AND NEED FOR ULTRA HIGH FLUX REACTORS. James A. Lane. [1959?]. 29p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

For presentation at the Symposium on Experiences in the Use of Research Reactors, Harwell, England, June 11, 1959.

The status of advanced high flux reactors now being planned for construction in the U. S. is reviewed. The need for fluxes above 10^{15}/cm^2 sec is examined and a comparison of research reactor systems is given along with a discussion of fuel technology developments. Descriptions and data on the Brookhaven Beam Research Reactor, the ORNL High Flux Isotope Reactor, the Argonne High Flux Reactor, and the Advanced Engineering Test Reactor are given. (J.R.D.)

21709 AECU-4326
California Research Corp., [Richmond, Calif.].
CIRCULATING LOOPS FOR TESTING ORGANIC COOLANTS. Survey and Status. J. G. Carroll. June 30, 1959. 74p. Contract AT(11-1)-174. $12.30(ph), $4.50 (mf) OTS. (AC-1).

A survey of facilities available for testing candidate organic reactor coolants is presented. The various loop operators were consulted, and information in the open literature was utilized in preparing the survey. Short résumés are appended on nine in-pile loops, one gamma source loop, and five out-of-pile loops. The background and need for such test work are briefly outlined. (J.R.D.)

21710 APAE-Memo-190
Alco Products, Inc., Schenectady, N. Y.
FEASIBILITY OF PARTIAL CHEMICAL CONTROL FOR THE SM-2. SM-2 (FORMERLY APPR-1B) DESIGN PROGRAM, TASK 12—CHEMICAL CONTROL. May 15, 1959. 89p. Contract AT(30-3)-326. $12.30 (ph), $4.50(mf) OTS.

Chemical control of the SM-2 was evaluated both as a partial substitute for burnable poison in the fuel element meat and as a means of improving plant performance. Based on a review of existing information, boric acid was chosen as the reference soluble poison. It was shown that 60% of the burnable B^{10} in the fuel element matrix could be replaced by soluble B^{10} in the coolant without impairing plant stability during load transients. The feasibility of improving power distribution and reducing the number of control rods by supplementing the burnable poison with chemical control was also demonstrated. A preliminary design of an injection and removal system was prepared for the SM-2. (auth)

21711 APEX-245
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
EVALUATION OF A SPRING-OPERATED RELEASE MECHANISM FOR A COMPRESSED GAS—BORON POWDER NUCLEAR FUSE. Robert J. Spera. Dec. 7, 1954. July 30, 1959. 42p. (XDC-54-12-34). $6.30 (ph), $3.00(mf) OTS.

The mechanical components of a spring-operated release mechanism require 0.5 inch-pounds of energy and 15 msec for operation. Uranium-loaded bimetal and bourdon tube sensors will not supply the required energy in time to provide an over-all fuse operating period of less than 75 msec. (auth)

21712 BAW-TM-321
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
BIBLIOGRAPHY ON GENERAL TEST REACTORS. Dorothy M. Duke. Sept. 1959. 50p. $7.80(ph), $3.30 (mf) OTS.

Bibliographies on the MTR, ETR, G. E. Materials

Testing Reactor, Vallecitos Boiling Water Reactor, and Westinghouse Testing Reactor are presented. In addition, bibliographies of miscellaneous reactors and in-pile loops are included. Sources used are Engineering Index, 1951 to 1958, Industrial Arts Index, 1951 to July 1959, and Nuclear Science Abstracts, 1948 to August 15, 1959. (J.R.D.)

21713 BRLM-1219

Ballistic Research Labs., Aberdeen Proving Ground, Md.

AIR BLAST MEASUREMENTS AROUND WATER-FILLED SIMULATED NUCLEAR REACTOR CORE VESSELS. Wendell C. Olson and Harry Goldstein. July 1959. 38p. Sponsored by AEC under DA Project No. 503-04-002. $1.00(OTS).

Measurements are presented of the air blast caused by bursting water-filled simulated nuclear reactor core vessels with internal explosive charges. The data were obtained by detonating one-pound spherical Pentolite explosive charges within the simulated cores and recording peak overpressures and positive impulses at each of several distances from 3 to 10 feet from the vessel center. The test results show that shock waves were formed in air close to the bursting vessels. However, the observation that pressure-time histories differ considerably from the "classical" free air blast waves from bare charges precludes the use of an equivalent weight of bare explosive charge to simulate the effect of bursting a reactor core. Even though the pressure-time histories for the water-filled core vessels do vary from those of bare explosives, the pressures and impulses measured were never larger than those of the air-filled vessels. Therefore, it may be concluded that the data for air-filled core vessels, which are applicable to an equivalent weight concept, yield an upper bound of air blast measurements for its water-filled counterpart. (auth)

21714 CF-59-8-39

Oak Ridge National Lab., Tenn.

ORR OPERATIONS FOR PERIOD APRIL 1958 TO APRIL 1959. J. A. Cox. Sept. 10, 1959. 187p. Contract [W-7405-eng-26]. $28.80(ph), $8.40(mf) OTS.

It has been the custom to report the operating experience at the ORR along with other activities in the reports of the ORNL Operations Division. It was decided to combine the sections of the Operations Division reports appropriate to ORR operation covering the year from April 1958 through March 1959. (W.D.M.)

21715 CISE-69

Centro Informazioni Studi Esperienze, Milan.

A CRITICAL SURVEY OF THE LITERATURE ON BURNOUT STUDIES WITH WET STEAM. A. Cicchitti, M. Silvestri, G. Soldaini, and R. Zavattarelli. June 15, 1959. 95p. $15.30(ph), $5.40(mf) OTS.

Experimental data on burnout in steam-water mixtures are presented. From burnout studies a new correlation of heat flux data is proposed and a comparison between the existing and proposed correlations is made. The first burnout data obtained with the CISE experimental facility are reported. (J.R.D.)

21716 CNC-13

Italy. Comitato Nazionale per le Richerche Nucleari, Milan.

CALCOLI DI CRITICITÀ. REATTORI A DUE E TRE REGIONI. (Criticality Calculations. Two- and Three-Region Reactors.) L. Sani. July 1959. 53p.

From the reactor critical equation in the Boltzmann transport theory, the group theory is developed in the neutron scattering approximation. The scattering equations in the multigroup theory are applied to two- and three-region reactors with reflector and blanket of fertile material. The critical dimensions are then derived. The buckling, beginning with the distribution of the neutron flux in the critical assembly, is measured experimentally. The correlation between experimental and theoretical data is discussed. (tr-auth)

21717 CWR-400-20

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

CURTISS-WRIGHT PRESSURIZER STUDY. Frank Paxton. May 22, 1959. 25p.

The performance of a steam pressurizer is analyzed, and a set of simplified equations to be used for description of its transient behavior during reactor power, and load excursions are presented. Equations were used to generate desired functions rather than data from steam tables. Some equations were combined rendering the problem more tractable for analog computer solution. (J.R.D.)

21718 HW-60275

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CORRELATION OF DATA ON HEAVY-WATER MODERATED CLUSTER LATTICES. J. R. Lilley. May 19, 1959. 15p. Contract W-31-109-Eng-52. $0.75(OTS).

The multiplying properties of D_2O moderated clusters were investigated using the Physical Constants Testing Reactor. One cluster type contained nineteen natural UO_2 rods. The other type was formed by replacing three of the UO_2 rods with Pu-Al alloy rods. Air or D_2O cooled the fuel. Values of k_∞ and f, as measured at three lattice spacings, were used to infer values of $\eta\epsilon$ and the effective resonance integrals. The results are compared with those of other experimenters. The agreement is generally good. The quoted values of k_∞ and f are changed slightly from those given previously. These changes were indicated by a critical re-evaluation of experimental data. (auth)

21719 IDO-16491

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SPERT II HAZARDS SUMMARY REPORT. G. O. Bright and J. E. Grund. Dec. 10, 1958. 68p. Contract AT(10-1)-205. $2.00(OTS).

Spert II will be a heterogeneous water-cooled and -moderated reactor designed for operation at pressures up to 300 psig and temperatures up to 400°F. The facility will provide for both static and flow tests with reactor cores employing either light or heavy water as a moderator-reflector, and also tests utilizing solid reflector materials. Its primary function is to provide a facility to permit study of the influence of various types of moderators and reflectors on reactor kinetic behavior. This report discusses the major hazards present in the operation of this facility, the precautions to be taken to reduce the probability of an accident, and the consequences of the maximum possible accident. Brief descriptions of the Spert II design and the site location are also presented. It is concluded that the proposed method of operation and the site location make possible the operation of the Spert II facility without hazard to the general public. (auth)

21720 IDO-16526

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

OPERATING PARAMETERS AND NEUTRON FLUX PROFILES FOR MTR PLUTONIUM CORE. L. J. Harrison. July 31, 1959. 68p. Contract AT(10-1)-205. $1.75(OTS).

From the calculations it was determined that the reactor could be safely operated at 20 Mw with an average shim rod position of 19 in. and with the core as it was for flux run number two. Since the assumption that the inclusions were 50 wt.% plutonium is quite conservative, the reactor could probably be operated at higher powers. The power increases were gradual and the reactor instruments scrutinized for any evidence of boiling in the reactor. The reactor operated at 20 Mw while the average shim rod position was between 19 and 25 inches; at 25 Mw while the average shim rod position was between 25 and 28 inches; and at 30 Mw while the average shim rod position was between 28 and 30 inches. At no time during the cycle was there any evidence of boiling in the reactor. (auth)

21721 IDO-16528

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ANALYSIS OF SELF-SHUTDOWN BEHAVIOR IN THE SPERT I REACTOR. S. G. Forbes, F. L. Bentzen, P. French, J. E. Grund, J. C. Haire, W. E. Nyer, and R. F. Walker. July 23, 1959. 40p. Contract AT(10-1)-205. $1.00(OTS).

Presented at the 1958 Winter Meeting of the American Nuclear Society, December 9, 1958.

Experimental and theoretical work on the self-limiting response of reactors to step and ramp insertions of reactivity is discussed along with the general characteristics of self-limiting power bursts. The static characteristics of the cores investigated are presented and the techniques of measurement are discussed. Data from step and ramp tests are presented and compared with the predictions of a theoretical formulation of reactor self-shutdown in terms of energy release. The discussion includes an evaluation of some postulated shutdown mechanisms in the light of experimental results. Some results of detailed calculations of shutdown effects due to specific mechanisms which are believed to contribute significantly to reactor self-shutdown are presented. (auth)

21722 IDO-16537

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTOR PROJECTS BRANCH QUARTERLY PROGRESS [FOR] OCTOBER, NOVEMBER, DECEMBER 1958. F. L. Bentzen, ed. Sept. 1, 1959. 74p. Contract AT(10-1)-205. $2.00(OTS).

SPERT I—Critical experiments were performed on a stainless steel core, designated P-18/19, which was made of APPR fuel assemblies. The critical mass was found to be 7.6 kg U^{235}. Increasing the loading to 9.34 kg resulted in a reasonably symmetric configuration with an available reactivity (approximately $5) adequate for the experimental program. The control rod calibration indicates a differential worth of approximately $1/in. of withdrawal above critical for the first three inches of rod motion. A temperature defect of $1.36 was obtained between 13°C and boiling, and over the same range the temperature coefficient increased a factor of ten from $-0.3¢/°C$ to $-3¢/°C$. The void coefficient measured as a function of position with air voids agrees quite well when integrated over the core with the average value of 9.9×10^{-4} $\$/cm^3$ obtained by simulation of voids with magnesium strips and the effect is linear over the range of 0 to 10% void volume. An extensive neutron flux map of the core with gold foils indicates a peak slightly below the center due to the presence of the poison section of the control rods and a depression in the position occupied by the reactivity oscillator. The dynamic behavior of the P-18/19 core following a step injection of reactivity is essentially the same as for previously tested aluminum cores. Below prompt critical the peak power is proportional to the reciprocal period. Above prompt critical the peak power increases as the square of the reciprocal period. The energy to peak power and the fuel plate surface temperatures exhibit minima near prompt critical. The dynamic pressure developed during a transient follows a cube law dependence on reciprocal period as predicted by elementary theory. Damage to the fuel assemblies following short period transients was severe, taking the form of large ripples on most fuel plates, accompanied by small blisters in some instances. A reactivity oscillator for transfer function measurements has been designed in the form of a rotating sector of cadmium and placed adjacent to the core. The reactivity amplitude is sinusoidal with peak-to-peak values of 2 to 32¢ attainable by the vertical motion of cadmium curtains placed around the oscillator assembly. SPERT II—IBM-704 calculations on the reactivity, critical mass, and incremental rod worth have been performed on the 12-plate cores and because they agree closely with experiment some confidence can be placed in calculations on an 8-plate core for Spert II. SPERT III—The Spert III reactor was accepted by the Atomic Energy Commission and turned over to Phillips Petroleum Company on Oct. 23, 1958. It was critical for the first time on Dec. 19, 1958, with 14.65 kg U^{235} included in 19 fuel assemblies and 8 control rods. DATA REDUCTION AND INTERPRETATION—Reactivity effects during boiling transient tests with the A-17/28 core are compared with previous subcooled tests. The reactivity compensated at the time of peak power is shown to be less at boiling in the long period region and essentially the same in the region above prompt critical. INSTRUMENTATION—A communications system comprised of transistor preamplifiers and class "B" power amplifiers has been installed in the Spert III reactor building. For greater intelligibility, frequencies below 800 cps have been attenuated at a rate of 6 db/octave. Six new gamma compensated ionization chambers have been built and tested. The output current is linear with neutron flux to a current of approximately 0.5 ma and the compensation exceeds 95%. ENGINEERING—Spert I: A bulkhead gate has been designed to conserve demineralized water and a brake system has been designed to insure better control of rod positioning. A grid plate has been fabricated for use in the slab experiments to be performed with Spert III fuel. Spert II: The overall completion of the Spert II construction phase is 70% complete as of Jan. 1, 1959. Some fuel components have been received from the Martin Company. Spert III: The no back clutch on the west control rod and several other components failed during the start-up procedures. Redesign of the appropriate equipment is in progress. Spert IV: A report outlining the design criteria for the Spert IV facility was begun. (For preceding period see IDO-16512.) (auth)

21723 IDO-16543

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR-ETR TECHNICAL BRANCHES QUARTERLY RE-

PORT, PERIOD ENDING MARCH 31, 1959. Aug. 19, 1959. 77p. Contract AT(10-1)-205. $2.00(OTS).

In reactor technical assistance, a linearization technique was developed which yields a good prediction of charge life for MTR after a core has operated for some 60 Mwd. A detailed comparison of relative statistical weights proportional to the square of neutron flux and experimental statistical weights, showed the two in good agreement, both for MTR and for ETR. An MTR start-up accident calculation (void formation neglected) indicated that doubling the withdrawal rate for shim rods increases the calculated energy release in the power transient by only 3%. In an investigation of service life of MTR shim rods, examination of a Be-Cd rod that had logged 20,000 Mwd revealed that the Cd had changed to flakes; a fuel-Cd rod with 2545 Mwd of service showed no corrosion damage. RMF measurements of the build-up of U^{233} in MTR-irradiated Th slugs, made as part of a continuing program, were analyzed and results are presented. A gamma-insensitive control system for RMF-type reactors has been proposed, based on a loop through which a liquid circulates from the reactor core to an external detector where its neutron activation is measured. A stability study showed flow control requirements to be reasonable. Additional total cross sections were measured with the crystal spectrometer and fast chopper, including those for Pu^{240}, U^{235}, U^{233}, Au, V, C, and B (in the thermal region) and for Pa^{231}, Np^{237}, and Ir (in the energy region <10 ev). Energy calibration for the fast chopper has been improved by certain recalibrations and corrections. A study of competing planes in crystals disclosed that competition between planes may cause serious discrepancies in crystal spectrometer measurements of reactor spectra. In the inelastic scattering studies, steam, methane, and vanadium measurements were completed and preliminary measurements were made on graphite, water, nickel, and beryllium. Results are shown. A set of curved slits installed in the rotors has improved resolution of the velocity selector system. The relative ratios of asymmetric to symmetric fission in Pu^{239} for thermal and 0.29 ev neutrons were measured. The compositions of pile-irradiated Th^{232}, U^{233}, U^{235}, U^{238}, and Pu^{239} were calculated from latest cross section values for different pile neutron spectra. A decay scheme was found for Nb^{94} and Nb^{94m}. A new energy level scheme for Eu^{155} was developed from measurements of gamma-rays emitted from a neutron-irradiated sample of Sm^{154}. Preliminary studies of operational characteristics of a 4π counting system indicated that reliable precision determinations of absolute beta disintegration rates are readily obtained. A succession of IBM-704 runs with the TURBO code was found to give a good picture of ETR flux changes during the course of an operating cycle. The code furnishes a powerful tool for handling the problems of an unsymmetrical core. In addition to giving eigenvalues and flux distributions, which are obtainable from the simpler PDQ code, TURBO gives burnup of "burnable" nuclides for any specified time interval. Two important codes were developed for the IBM-650. One gives a solution to the problem of heat flow from a spatially distributed source during transient conditions, which has direct application to pressure vessels such as are used in in-pile loops and SPERT. The other is a code for inversion of Laplace Transforms by numerical methods, of value in studies of reactor control systems, where it is often necessary to perform this operation. (For preceding period see IDO-16534.) (auth)

21724 IGIS-54(RD/R)

United Kingdom Atomic Energy Authority. Industrial Group H.Q., Risley, Lancs, England.

A BIBLIOGRAPHY ON BOILING WATER REACTORS. G. I. Maughan. Apr. 1, 1959. 36p. $0.49(BIS).

A wide selection of book, report, and periodical references on heterogeneous boiling water reactors compiled from Nuclear Science Abstracts, 1948 to Feb. 1959, and Engineering Index, 1950 to 1957, is given. (J.E.D.)

21725 MND-E-1847-III

Martin Co. Nuclear Div., Baltimore.

ZERO POWER CHECK POINT EXPERIMENTS. VOLUME III. ERDL-TASK 100, PHASE 3. June 1959. 69p. Contract DA-44-009-ENG-3318.

Three experiments were performed to furnish additional information on the 45-element core reported in MND-E-1847-II. The critical water height for this core was found to be 9.99 in. The reactivity worth of a small amount of water was also evaluated. The total reactivity of the core was determined in several ways using 2% Cd in a Cd-Sn alloy as the core poison. The reactivity values are: incremental rod withdrawal—7.9% $\Delta K/K$, incremental cadmium addition—7.8% $\Delta K/K$, and uniform cadmium removal—7.4% $\Delta K/K$. Alternate schemes for cadmium removal were tried to check the reactivity values established. Flux measurements were made in selected positions of the core before and after Cd addition to determine if a neutron spectral shift occurred. The Au resonance and epicadmium neutron flux showed an increase after Cd insertion while the thermal and fast flux decreased. There is a spectral shift when cadmium is used to poison out and measure the core reactivity. Four APPR-1 stationary fuel elements were compared to determine the two having the closest reactivity. These two are to be used as preliminary standards for comparison of ANPP critical experiments on the APPR-type reactor. The proposed semi-empirical method of determining total core reactivity by analytical extrapolation of experimental values of reactivity near the critical water height is not in agreement with the experiment. The total reactivity determined by this method was 11.7% $\Delta K/K$. Analytical duplication of the critical water height core and the critical core with the bank inserted resulted in calculated reactivities approximately 0.9% $\Delta K/K$ too low. The calculated reactivity of the nearly critical cadmium-poisoned core was approximately 2.5% $\Delta K/K$ too high. (auth)

21726 NAA-SR-1190

North American Aviation, Inc., Downey, Calif.

REACTOR SAFETY QUARTERLY PROGRESS REPORT [FOR] AUGUST—OCTOBER 1954. Norman E. Huston, ed. Apr. 15, 1955. Decl. July 20, 1959. 43p. Contract AT-11-1-GEN-8. $7.80(ph), $3.30(mf) OTS.

Work was continued on developing fabrication and assembly techniques for the Hanford safety element. The stainless steel Mark II design should provide a reactivity ratio (triggered loss to stored loss) of 3.7. The poison coating studies were terminated. The latest results show the coating efficiency to be strongly temperature-dependent with only a small useful range of about 10°C. Studies of the exothermic reaction of BF_3 with liquid sodium show the reaction to be rapid but not violent.

21727 NP-7911
Iowa State Coll., Ames.
CHANGES IN REACTIVITY IN A SUBCRITICAL ASSEMBLY OWING TO LOCALIZED PERTURBATIONS. (thesis). Donald Miller Beck. 1959. 72p.

The reactivity changes in a subcritical assembly due to localized perturbations were investigated. The perturbations considered were the addition of fuel, poison, and the introduction of a void. Experimental and theoretical results were correlated to ascertain the feasibility of predicting reactivity changes in a subcritical assembly. (W.D.M.)

21728 NP-7912
Iowa State Coll., Ames.
NEUTRON DIFFUSION IN A SUBCRITICAL ASSEMBLY WITH SINUSOIDAL SOURCE OSCILLATION (thesis). Robert Wilhelm Carius. 1959. 78p.

An experimental verification of the theoretical transfer function for a subcritical assembly was attempted using a varying rate of neutrons from the source. Neutron diffusion in the assembly that shows variance from the predicted identical phase and amplitude response throughout the assembly was investigated. The assembly characteristics were determined by using a sinusoidally varying source. (W.D.M.)

21729 NRL-5336
Naval Research Lab., Washington, D. C.
PROPOSED EXTENSION OF THE NAVAL RESEARCH LABORATORY RESEARCH REACTOR OPERATING SCHEDULE TO MORE THAN 40 HOURS PER WEEK. A. F. DiMeglio, J. O. Elliot, S. E. Golian, K. W. Marlow, E. I. Nowstrup, S. Podgor, J. M. Frame, and L. F. Garcia. May 12, 1959. 20p. Project NR 543-000.

Material is presented in support of an extension to the basic 40 hours per week operating schedule. Modifications to the reactor accomplished since the original request was submitted are discussed. The request is for operation of the reactor at its licensed 100 Kw power level on an unlimited time schedule. (W.D.M.)

21730 RM-2280(RAND)
RAND Corp., Santa Monica, Calif.
A CORRELATION OF THE CRITICAL CONDITIONS FOR HOMOGENEOUS BARE REACTORS. Benjamin Pinkel and G. B. W. Young. Oct. 29, 1958. 54p.

A method for correlating, over a wide range of moderator-to-uranium ratios, the critical conditions for homogeneous bare reactors having various types of moderators is given. The method is applied to the results of an eighteen-group analysis of homogeneous bare reactors and to some experimental results, and good correlation is obtained. This correlation shows the effect of the nuclear properties of the reactor materials on the criticality conditions and permits these conditions to be estimated for other bare reactors. (auth)

21731 WAPD-TM-181
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SO131—AN IBM-650 CODE TO SOLVE PRESSURE AND THERMAL STRESS PROBLEMS IN CORE SUBASSEMBLY PLATES. C. M. Friedrich. Aug. 1959. 29p. Contract AT-11-1-GEN-14. $1.00(OTS).

In the design of nuclear reactor core subassemblies, a stress analysis is often made of a subassembly whose plates differ in geometry, in reactor coolant pressure loading, and in temperature distribution. Bettis code SO131 was developed for the IBM-650 computer to assess the adequacy of the subassembly design and to assist in determining acceptable manufacturing tolerances. The output of the code gives redundant weld reactions, deformations, and stresses in the individual plates. (auth)

21732
WATER TREATMENT AT INDIAN POINT NUCLEAR POWER PLANT. A. C. Muller (Consolidated Edison Co. of New York, Inc., N. Y.). Ind. Eng. Chem. 51, 1254-8(1959) Oct.

An elaborate water purification system for the production of high-purity water for use as moderator, reflector, and coolant in the Indian Point Nuclear Power Plant is described. Softening is carried out with a resin which is a copolymer of styrene cross-linked with 10% divinylbenzene. After decarbonization and deionization the water is treated with cyclohexylamine to adjust the pH to 8.8 to 9.0. Ion exchange treatment of a by-pass stream is utilized to maintain high purity in the primary coolant. Maximum design flow in the primary coolant purification system is 160,000 pounds per hour. Boric acid in the concentration of 500 p.p.m. of the primary coolant is used as a poison to keep the reactor subcritical during start-up and shutdown. All of the water treatment units are operated by remote control. (C.J.G.)

21733
ION EXCHANGE PROCESSES FOR NUCLEAR POWER PLANTS. Joseph Thompson and A. C. Reents (Illinois Water Treatment Co., Rockford, Ill.). Ind. Eng. Chem. 51, 1259-61(1959) Oct.

Removal of boric acid from primary loop water by means of a strong base anion exchanger is reported. A quaternary ammonium-type exchanger, Ilico A-284, was converted to the hydroxyl form with sodium hydroxide. With this exchanger boric acid was removed to levels required for reactor operation. Ion exchange applications are presented for primary and secondary loops of a pressurized water reactor. Handling of spent radioactive mixed-bed resins is discussed. (C.J.G.)

21734
VALLECITOS BOILING WATER REACTOR. COOLANT TECHNOLOGY. F. J. Brutschy, H. S. Dreyer, and W. L. Pearl (General Electric Co., Pleasanton, Calif.). Ind. Eng. Chem. 51, 1262-4(1959) Oct.

A comparison is made of water decomposition, separation factors, and contamination problems in the cooling systems of the Vallecitos Boiling Water Reactor, the Experimental Boiling Water Reactor, and the Boiling Reactor Experiment-III. (C.J.G.)

21735
WATER DECOMPOSITION IN A DIRECT-CYCLE BOILING WATER REACTOR INCREASES CORROSION RATE. A. P. Gavin, C. R. Breden, R. E. Bailey, M. H. Theys, and G. E. Goring (Argonne National Lab., Lemont, Ill.). Ind. Eng. Chem. 51, 1265-6(1959) Oct.

Water decomposition in the Experimental Boiling Water Reactor decreased slightly upon the addition of hydrazine (~3 ppm). The need for a catalytic recombiner for dissociated water in the exhaust stream from air ejectors resulted in the use of platinized alumina pellets. The system comprises a flowmeter to monitor the supply of diluent stream, temperature and pressure safety switches, and air operated valves designed to bypass the recombiner unit in the event of unsafe condi-

tions. The entire operation is by remote control and hydrogen recombination is 99% complete. Corrosion analyses of the oxide films on fuel plates that have been handled give a composition of 36% aluminum, 11% nickel, and 3.7% iron. Major activity during operation is due to nitrogen-16, formed by (n,p) reactions between fast neutrons and oxygen-16. Other activity present is from the formation of sodium-24, cobalt-58, and cobalt-60. Decontamination consists of flushing the connections with water until the radioactivity level is within tolerance levels. (C.J.G.)

21736

PERTURBATIONS DUE TO FUEL CYCLES. J. G. Balfour, D. L. Booth, R. S. Bulloch, and W. R. Stanners (English Electric Co., Ltd., Whetstone, Leics, Eng.). J. Brit. Nuclear Energy Conf. 4, 189-97(1959) July.

Perturbation theory is applied to the calculation of axial flux perturbation arising from fuel burn-up, assuming the temperature distribution to remain constant at its initial value. The constant temperature limitation is removed by a second method which involves solution of the non-linear axial equations by a process of iteration. This second method, unlike perturbation theory, is valid even when the perturbations are large. The radial microscopic variations of flux and power from channel to channel occurring for an equilibrium fuel cycle are evaluated by a two-group heterogeneous method, axial perturbation being neglected. (auth)

21737

(I) OPTIMIZATION OF FUEL CYCLES. P. R. J. French and C. S. Lowthian (A.E.I.-John Thompson Nuclear Energy Co., Ltd., Knutsford, Cheshire, Eng.). J. Brit. Nuclear Energy Conf. 4, 198-202(1959) July.

A simplified chain of long term changes in fuel composition with irradiation is considered, through an investigation of the physical parameters involved in the complementary design optimization of lattice parameters and fuel cycle. The investigation is based on a reactor operated on a 'once-through' equilibrium fuel cycle such that each region of the reactor contains, at any time, fuel elements whose irradiation periods are evenly distributed over the range from zero to the limiting irradiation at which fuel is discharged. A relationship is obtained between the burn-up of the fissionable content of the fuel and the initial distribution of neutrons between thermal and epithermal capture. The effect on fuel life of enrichment is considered together with the possible allocation of reactivity to increasing either reactor output or fuel life. It is indicated how, for a particular design, the ultimate generation cost can be influenced by the allocation of reactivity. (auth)

21738

(II) OPTIMIZATION OF FUEL CYCLES. P. J. Grant, W. Oswald, and P. D. D. Russell (The General Electric Co., Ltd., Erith, Kent, Eng.). J. Brit. Nuclear Energy Conf. 4, 203-9(1959) July.

Economic factors affecting the choice of fuel cycles for nuclear power stations are discussed. The usefulness of the concept of neutron economy is examined and economic effects of changes in the use of neutrons with changes in the degree of enrichment of the fuel are considered briefly. The prices of the nuclear fuels are discussed. The optimization of the fuel cycle of a gas-cooled, graphite moderated reactor fuelled with natural uranium is discussed in some detail. (auth)

21739

OPERATIONAL PROBLEMS ASSOCIATED WITH FUEL CYCLING. J. C. C. Stewart and N. L. Franklin (U.K.A.E.A. Industrial Group, Risley, Lancs, Eng.). J. Brit. Nuclear Energy Conf. 4, 210-16(1959) July.

The uncertainties which exist in fuel performance are examined in relation to the physics and reactivity control of the reactor, the metallurgical lifetime of the fuel cycle which is external to the reactor. The requirements for processing fuel elements with a range of plutonium contents and depletions are given. (C.J.G.)

21740

THE DESIGN OF ELECTRO-MECHANICAL AUXILIARIES DIRECTLY ASSOCIATED WITH POWER-PRODUCING REACTORS. A. E. Harwood, P. Scott, and B. H. Stonehouse (General Electric Co., Ltd., Erith, Kent, Eng.). J. Brit. Nuclear Energy Conf. 4, 234-49 (1959) July.

The conditions under which the plant must operate and the problems encountered in the design and construction of the electro-mechanical plant directly associated with a base load nuclear power station of the gas cooled, graphite moderated, natural uranium type are described. Design problems discussed include choice of materials of construction, method of motivation, and method of control. The problems of a plant immersed in the reactor coolant are discussed. The features required by the operator for controlling the plant from a remote point and the need for auxiliary reliability are considered. (C.J.G.)

21741

THE POSSIBILITY FOR THE PRODUCTION OF PRESSURE TUBE FUEL ELEMENTS WITH INTERNAL COATING. E. Bodmer, P. De Haller, and P. Sulzer. Jaderná energie 5, 232-6(1959). (In Czech.)

The construction of a reactor using pressure tube fuel elements is, from an economic viewpoint, more advantageous than the construction of reactors in pressure containment. The problems connected with the fabrication of pressure tube fuel elements, especially the application of the internal coating, are briefly described and the results obtained are summarized. (auth)

21742

N. S. SAVANNAH—REACTOR PHYSICS AND CORE DESIGN. P. M. Wood and Z. Levine (Babcock and Wilcox Co., Lynchburg, Va.). Nuclear Energy Engr. 13, 450-4 (1959) Sept.

A discussion of the design of the 74 Mw pressurized water reactor used in the Savannah is presented. Calculations on the control rod reactivity and core lifetime are discussed. The purpose of shim rods is explained. (C.J.G.)

21743

HYDROCARBONS IN POWER REACTOR PLANTS. II. CANADA'S ORGANIC COOLED REACTOR PROJECT. Nuclear Energy Engr. 13, 458-61(1959) Sept.

A design description is presented of the Organic Cooled, Deuterium Moderated Reactor Experiment. A mixture of 20 to 30% ortho- and 70 to 80% meta-terphenyls has been tentatively selected as the most suitable coolant material. The 150 Mw power station is to use aluminum-clad uranium oxide fuel. Optimum steam generation conditions recommend steam generation at 416°C and 109 at. Safety aspects of the reactor are given. (C.J.G.)

21744

BUILDING THE NUCLEAR NAVY. 2. INDUSTRY MASS-PRODUCING REACTORS FOR NAVY. John E. Kenton. Nucleonics 17, No. 9. 82-5(1959) Sept.

Beginning with the 1957 shipbuilding program, all submarines (except the Tullibee) use the S5W reactor. Through series production the Navy has saved 40 to 45% on the price of core structural components. The core fabricators and heavy component makers are enumerated, and some comments of these companies on the present nuclear propulsion program are presented. (C.J.G.)

21745

THE FUTURE OF GAS-COOLED REACTORS. William S. Banks (Allis-Chalmers Mfg. Co., Washington, D. C.). Nucleonics 17, No. 9, 96-101(1959) Sept.

A comparison is made between the gas-cooled reactor and the advanced-design coal-burning plants, both of which have nearly identical thermal cycles. Evaluation criteria are presented for the selection of promising reactor systems. Cost and power output of the two systems are compared. (C.J.G.)

21746

HTRE-1 SURVIVES DAMAGE EXPERIMENT. Nucleonics 17, No. 9, 110(1959) Sept.

The results of an experiment in which the reactor ran at full power with the air-coolant flow deliberately blocked in one fuel-element channel are discussed. (C.J.G.)

21747

ARGONNE EVALUATES PROCESS-STEAM REACTORS. Nucleonics 17, No. 9, 112-14(1959) Sept.

An evaluation as to what sort of process-heat reactors might be developed from the pressurized water, organic-moderated, and boiling-water reactor concepts is presented. (C.J.G.)

21748

GEORGIA REACTOR—NEW FACILITY FOR DYNAMIC IRRADIATION TESTING. A. M. Liebschutz and M. M. Miller (Lockheed Aircraft Corp., Marietta, Ga.). Nucleonics 17, No. 9, 126-7(1959) Sept.

A description is presented of the testing-reactor facility in Dawsonville, Georgia, which permits the dynamic testing of full-scale components and systems under conditions comparable to those expected in an operating nuclear aircraft. (C.J.G.)

21749

SURVEY OF INITIAL FUEL COSTS OF LARGE U. S. NUCLEAR POWER STATIONS, DECEMBER, 1958. A Report of the Technical Appraisal Task Force on Nuclear Power to the Board of Directors of the Edison Electric Institute. EEI Publication No. 59-150. New York, Edison Electric Institute, 1959. 37p. $2.50.

Data on fuel costs for the Shippingport, Dresden, Enrico Fermi, Indian Point, and Rowe plants are reported and an effort is made to interpret fuel cost estimates on a consistent basis for the initial three years of rated operation. The degree of uncertainty in cost estimates is assessed, and the elements of fuel cost are analyzed to show their relative importance. (C.T.G.)

21750

TRANSFER-FUNCTION RESPONSE OF A HIGH IMPEDANCE NUCLEAR POWER CHANNEL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-25. Robert J. Allen (Atomics International, Canoga Park, Calif.). New York, Engineers Joint Council, 1959. 15p. $0.50.

The analytical and experimental techniques for determining the phase error introduced by a typical 100-megohm power indicating channel consisting of an ionization chamber, electrometer preamplifier, d-c amplifier, and recording oscillograph are presented. The analysis covers delays from the time the neutron enters the ion chamber (considering ion mobility) through and including the motion of the galvanometer spot on the recording paper. A modulated current source, from a photomultiplier tube excited by a varying intensity light source, is used to simulate a sinusoidally varying neutron source. (auth)

21751

A TRANSISTORIZED POWER REACTOR SAFETY SYSTEM. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-44. Harry H. Hendon (General Electric Co., San Jose, Calif.). New York, Engineers Joint Council, 1959. 14p. $0.50.

A new approach to power reactor safety system reliability, as regards various means of hook-up and logic, is presented. The system consists of flux amplifiers, logic elements for flux and other input parameters, and trip actuator amplifiers. The flux amplifier consists of a d-c amplifier, discriminator, and testing circuit. The testing circuit is novel in that the instrument is tested, from input to trip output, once per second. Upon failure as indicated by the tester, annunciation is given and automatic equipment substitution may be employed. The logic elements consist of redunantly connected diode logic matrixes and switching transistors. The actuator amplifiers are transistor power amplifiers with positive feedback to yield bistable operation. (auth)

21752

MARCOULE'S REACTORS G2 AND G3. PART C, REACTOR COOLING. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-142. J. C. Chaboseau and P. J. Laferrière. New York, Engineers Joint Council, 1959. 9p. $0.50.

Information is given on the cooling of the primary and secondary circuits. (C.J.G.)

21753

PIERWSZY W POLSCE REAKTOR JADROWY. (THE FIRST POLISH NUCLEAR REACTOR.) L. Labno and K. Zarnowiecki. 1958. 106p.

The construction and operation of the first nuclear reactor in Poland of Soviet production is described. It was built for experimental purposes, for scientific research, and for the production of artificial radioactive isotopes.

21754

ATOMKRAFT. DER BAU VON ATOMKRAFTWERKEN UND SEINE PROBLEME. EINE EINFÜHRÜNG FUR INGENIEURE, ENERGIEWIRTSCHAFTLER UND VOLKSWIRTE. (Atomic Power. The Construction of Nuclear Power Plants and its Problems. An Introduction for Engineers, Power Economists, and Political Economists.) Friedrich Münzinger. Berlin, Springer-Verlag, 1957. 235p. DM 29.40.

An introduction to the construction of nuclear power plants is presented. The construction problems are considered on theoretical, technical, and economic grounds. In the theoretical discussion the atomic physics fundamentals of reactor construction, reactor cooling, and construction and fuel materials are described. The technical discussion includes the actual construction with a survey of various reactor types, thermal power plants used with reactors, and the construction of the complete plant. Economic considerations include competition from nuclear power plants, German nuclear power plants with a discussion of the English, American, and Russian programs in this area, and a discussion of atomic power as a second industrial revolution. (J.S.R.)

21755

STROITEL'NYYE MATERIALY DLYA ZASHCHITY OT IZLUCHENII YADERNYKH REAKTOROV I USKORITELEY. (Building Materials for Radiation Shielding in Nuclear Reactor and Accelerator Installations.) Aleksandr Nikolayevich Komarovskii. Moscow, Atomizdat, 1958. 123p.

Shielding and engineering properties of building materials used for radiation shielding of nuclear reactors and accelerators are considered. Particular attention is given to special heavy-aggregate and hydrated concretes. In the case of ordinary concretes, consideration is limited to their shielding properties and to the conditions required for maximum density and homogeneity. The results of Soviet and foreign investigations and construction practices in the radiation shielding of nuclear reactors are compiled and examined. Data are given on costs and applications of concrete to buildings and shielding associated with various types of nuclear reactors and accelerators. (auth)

21756

NUCLEAR REACTOR FUEL ELEMENT. Richard Valentine Moore and Gordon Peckman (to U. S. Atomic Energy Commission). U. S. Patent 2,885,335. May 5, 1959.

A fuel element design which makes vertical orientation in a reactor possible is offered. The individual elements have a cup and cone on shape on the ends to cause alignment within the channel. The parts under the stress of the fuel weight are thermally insulated from fuel-containing parts and have cooling fins projecting into the coolant flow. Thus creep stress is minimized. (T.R.H.)

21757

NEUTRONIC REACTOR FUEL PUMP. William G. Cobb (to U. S. Atomic Energy Commission). U. S. Patent 2,888,878. June 2, 1959.

A reactor fuel pump is described which offers long life, low susceptibility to radiation damage, and gaseous fission product removal. An inert-gas lubricated bearing supports a journal on one end of the drive shaft. The other end has an impeller and expansion chamber which effect pumping and gas-liquid separation. (T.R.H.)

21758

NEUTRONIC REACTOR. Leo A. Ohlinger, Eugene P. Wigner, Alvin M. Weinberg, and Gale J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,890,158. June 9, 1959.

A means of cooling reactor fuel as it is discharged from the reactor is described. (T.R.H.)

Power

21759 ACNP-ERR-4

Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee.

ELK RIVER REACTOR. Quarterly Project Report [for] March–April–May 1959. 23p. Contract AT(11-1)-654. $4.80(ph), $2.70(mf) OTS.

An alternate design of the Elk River Reactor was completed during the quarter. Three points were emphasized in the study: performance capability to provide 116 Mw(th) output; fuel costs of the reference design versus alternate fuel media and cladding; and reactor control modifications to provide sufficient reactivity to eliminate soluble "hold down" poisons, permit higher power operation, and obtain a greater fuel life. Work is summarized on fuel element and material development program, reactor vessel and internal components, control rods and drive mechanism, process systems, superheater, buildings and facilities, instrumentation, and site construction. (For preceding period see ACNP-ERR-3.) (W.D.M.)

21760 AECU-4287

Duquesne Light Co., Shippingport, Penna.

NUCLEAR INSTRUMENTATION. SECTION II. Test Results DL-S-266-S (RNI-4). First Issue, May 12, 1959. 3p. $1.80(ph), $1.80(mf) OTS.

The resistance of the power and temperature controller's minimum level relay was found to be 3,968 ohms. The resistance of the relay was measured by using a Wheatstone bridge. (auth)

21761 AECU-4297

Duquesne Light Co., Shippingport, Penna.

COMPONENT COOLING WATER SYSTEM. SECTION IV. Test Results DL-S-117 (T-550071). First Issue, Aug. 3, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The component cooling water system operated satisfactorily with the plant at 1985 psig pressure and 525°F. The heat transfer coefficient for both the component cooling water and canal water heat exchangers exceeded the manufacturer's service rating based on calculations made from the test data. (auth)

21762 AECU-4298

Duquesne Light Co., Shippingport, Penna.

XENON TRANSIENT TESTS XENON BURNOUT. SECTION III. FIRST PERFORMANCE. Test Results DL-S-156 (T-612081). First Issue, Aug. 4, 1959. 45p. $7.80(ph), $3.00(mf) OTS.

The control rod drive speeds necessary for satisfactory reactor control during a burnout of maximum xenon and the effect of xenon concentrations on power distribution in the core were determined. (J.E.D.)

21763 AECU-4337

Duquesne Light Co., Shippingport, Penna.

MAIN UNIT HEAT RATE TESTS. SECTION I. SECOND PERFORMANCE. Test Results DL-S-176. First Issue, July 6, 1959. 23p. $4.80(ph), $2.70(mf) OTS.

The main unit heat rate with various loads on the main unit was obtained. Calculations based on data taken on June 11, 1958, through June 12, 1958, and on September 9, 1958, indicate that the heat rates were within the limits of accuracy of the involved test instrumentation, as predicted in the turbine generator contract. (auth)

21764 ANL-6009(Add.)

Argonne National Lab., Lemont, Ill.

PRESSURIZED WATER REACTOR FOR PRODUCTION

OF PROCESS STEAM. R. J. Gariboldi, R. R. Rohde, C. F. Bullinger, and L. E. Link. Sept. 1959. 45p. Contract W-31-109-eng-38. $1.50(OTS).

A pressurized water reactor system which can ascertain the economics of producing saturated steam from 30 to 196 psia, was designed. A low-alloy steel is used for the primary system and standard commercial equipment is specified where applicable. Zircaloy-clad fuel is proposed for production of 196-psia saturated steam. For low pressure, 30-psia saturated steam, an aluminum alloy cladding is proposed. The plant is designed to permit post research and development to determine the feasibility of a low-alloy steel system and the compatibility of a low-alloy steel-aluminum alloy-clad fuel in a pressurized water reactor. In addition, the plant will be used to study many of the problems of water quality control. The important features of the system are summarized. (auth)

21765 BAW-1058

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

LIQUID METAL FUEL REACTOR EXPERIMENT; DYNAMIC UTILITY TEST LOOP. O. H. Baker. May 5, 1959. Changed from OFFICIAL USE ONLY July 31, 1959. 60p. Contract AT(30-1)-1940. $1.75(OTS).

Development of LMFRE high-velocity loops is reported. Construction of the initial loop-to-test components for the main program is described. The loop was designed to circulate molten Bi through Croloy pipe at a temperature maximum of 1000°F. Equipment and procedures are described, and conclusions are listed. (J.R.D.)

21766 CF-56-4-162

Oak Ridge National Lab., Tenn.

A METHOD OF CORRELATING EXPERIMENTAL FLUID FRICTION DATA FOR TUBE BUNDLES OF DIFFERENT SIZE AND TUBE BUNDLE TO SHELL WALL SPACING. J. L. Wantland. Apr. 5, 1956. Decl. Sept. 15, 1959. 17p. $3.30(ph), $2.40(mf) OTS.

An analytical method of correlating fluid friction data for flow parallel to square array cylindrical tubes in rectangular cross-section flow channels has been devised. In this technique, the experimental values for friction factors and Reynolds moduli are multiplied by correlation terms which yield new friction factors and Reynolds moduli that pertain to the core region of the tube bundle excluding the boundary effects; hence, model configurations with different numbers of tubes and different tube bundle to shell wall spacing can be correlated. Experimental fluid friction data have been obtained on a 25-tube tube bundle by the ARE Division and on a 100-tube tube bundle by the REE Division with some disagreement of results and it was thought that by this technique this disagreement could be explained. However, it is shown that for either of these two configurations application of this technique changes the original data by less than five percent and does not bring these data into better agreement. (auth)

21767 DP-375

Du Pont de Nemours (E.I.) & Co. Explosives Dept., Wilmington, Del.

HEAVY WATER MODERATED POWER REACTORS. Quarterly Progress Report [for] November 1958 through January 1959. L. Isakoff, comp. Apr. 1959. 82p. Contract AT(07-2)-1. $2.50(OTS).

Experimental work this quarter in the study of natural-uranium-fueled, D_2O-moderated power reactors featured the successful fabrication of nine Zircaloy-clad U–2 wt. % Zr fuel tubes, a major advance in the extrusion of thin-walled zirconium components, the startup of the high temperature exponential facility, continuation of the irradiation testing of prototype fuel elements, and additional work on several methods of manufacturing fuel elements of uranium oxide. Further evaluations were made of the economics of large-size D_2O-moderated power reactors and of the associated engineering, physics, and materials problems. Construction of a high-temperature irradiation facility, the Heavy Water Components Test Reactor (HWCTR), was authorized. Firm design, procurement of long-delivery equipment, and experimental determination of the nuclear properties of the HWCTR are proceeding. (For preceding period see DP-345.) (auth)

21768 GNEC-98

General Nuclear Engineering Corp., Dunedin, Fla.

A STUDY OF REACTOR SYSTEMS FOR THE PRODUCTION OF TRITIUM AND RADIOACTIVE COBALT. June 8, 1959. 176p. Contract AT(38-1)-196. $3.00 (OTS).

A conceptual design study of reactors for the joint production of tritium and Co^{60} was made. The study covered a family of four reactors ranging in thermal power from 16.5 Mw to 150 Mw, and designed for corresponding annual productions ranging from 0.5 to 5.0 million curies of tritium, respectively. All of the reactors are low temperature water cooled and moderated, and employ fully-enriched U^{235} in Al fuel elements of the ETR type. Isotope production occurs both in control blades and in blanket elements of Al-clad Co^{59} or Li–Al alloy. (W.L.H.)

21769 KAPL-1738

Knolls Atomic Power Lab., Schenectady, N. Y.

APPRAISAL OF ORGANIC COOLANT REACTOR CYCLE. Dec. 31, 1956. Decl. June 25, 1959. 22p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

An appraisal of NORE indicated further development of organic cooled reactors for naval use is not justified. (D.E.B.)

21770 KAPL-M-CME-3

Knolls Atomic Power Lab., Schenectady, N. Y.

REPAIR OF LEAKY COOLING COIL JOINTS ON S4G CONTROL ROD DRIVE MECHANISMS. C. M. Erb. Aug. 13, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

There are two externally cooled stator and lower jackets on each control drive mechanism used in S3G and S4G. The cooling is accomplished by circulating water through the tubing. Small leaks on both types of jackets were discovered on S4G where the two tube ends are brazed into the jacket. All jackets showed a satisfactory braze between the tubing and jacket outside surface. A metallurgical examination was made of the tube end to jacket braze on several units. Pull tests and sectioning revealed very poor quality joints due to poor fit up, oxidation, and lack of brace. (W.L.H.)

21771 KAPL-M-D1G-0-83 (Issue 2)

Knolls Atomic Power Lab., Schenectady, N. Y.

D1G OFF-HULL RADIATION MONITORING SYSTEM DESCRIPTION. R. A. Edwards. Aug. 14, 1959. 33p. $6.30(ph), $3.00(mf) OTS.

The purpose of the D1G off-hull radiation protection system is to provide the operation personnel with the information required to adequately control the radiation exposure of personnel on or off the site and to

minimize the D1G plant contribution of radioactive material contamination to environmental air, vegetation, soil, and water. (auth)

21772 MND-M-1812

Martin Co. Nuclear Div., Baltimore.

PM-1 NUCLEAR POWER PLANT PROGRAM QUARTERLY PROGRESS REPORT NO. 1 [FOR] MARCH 9 TO MAY 31, 1959. J. S. Sieg. July 6, 1959. 250p. Contract AT(30-1)-2345. $4.00(OTS).

A description is presented of the work accomplished during the first contract quarter. The contract calls for the performance of design and development, final design, fabrication, installation, and initial testing and operation of a factory pre-packaged air-transportable pressurized water nuclear power plant. The plant is to produce 1000 kw(e) and 7,000,000 Btu/hr of heat suitable for central heating. It is scheduled to be operational by 9 March 1962. The principal effort was directed toward parametric study of reactor, system, and configuration design variables. An experimental program was initiated to confirm analytical results and, in the case of fuel elements, to perform prefabrication studies. Although the parametric studies are not scheduled to be completed until the second quarter—when they will provide the basis for preliminary design—numerous results of individual studies are included. (auth)

21773 NAA-SR-3172

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

OMR CONTROL-SAFETY ROD COMPONENT DEVELOPMENT TESTS. J. D. Howell. Sept. 15, 1959. 51p. Contract AT(11-1)-GEN-8. $1.50(OTS).

A magnetic-jack control safety rod is under development for the 45.5 Mw(th) Organic Moderated Reactor. The rod is "unitized," i.e., the poison element, drive, position indicator, and shock absorber are contained in a compact assembly which is inserted in a regular fuel channel opening in the core. Since all components of the rod are immersed in the reactor coolant, they must operate at or above the reactor inlet temperature, 550°F. Tests to develop components capable of operating under these conditions are described and results are reported. (auth)

21774 NAA-SR-3850

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ANNUAL TECHNICAL PROGRESS REPORT, AEC UNCLASSIFIED PROGRAMS, FISCAL YEAR 1959. Aug. 1, 1959. 327p. Contract AT-11-1-GEN-8. $6.70(OTS).

Progress is reported on the SGR program, Hallam Nuclear Power Facility research and development, organic moderated reactor program, Piqua Power Reactor research and development, Kinetic Experiments on Water Boilers, separations chemistry, and advanced development. (See also NAA-SR-3815.) (W.D.M.)

21775 NAA-SR-4013

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SODIUM GRAPHITE REACTOR MATERIALS SURVEY. B. R. Hayward. Sept. 15, 1959. 47p. Contract AT-11-1-GEN-8. $1.25(OTS).

The materials problems associated with the present sodium graphite reactor system have generally been approached by using existing knowledge and data to meet the proposed operating conditions. This discussion reviews the general reactor concept and the specific materials used for the major reactor components: (1) shielding materials; (2) core materials; and (3) sodium cooling system materials. In each case, the materials problems and the materials used to minimize or eliminate these problems are described. Economical nuclear power is currently dependent on the flow of improved materials for high temperature use in high radiation fields. Rapid progress is being made in this respect. (auth)

21776 NAA-SR-4102

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

COMMENTS ON THE APPLICATION OF ASME AND ASA BOILER AND PIPING CODES TO SODIUM SYSTEMS. W. C. Hayes. Sept. 15, 1959. 23p. Contract AT-11-1-GEN-8. $0.75(OTS).

The American Society of Mechanical Engineers (ASME) Power Boiler Code, Unfired Pressure Vessel Code, and the American Standard Code for Pressure Piping (ASA B31.1–1955) are reviewed as bases for the design of sodium systems and to point out areas which may require consideration beyond the scope of these codes. It is concluded that the code rules are generally adequate in their intention to provide minimum safety requirements for new construction. However, the designer must have additional data in order to make realistic allowances for any unusual conditions which may be associated with sodium systems. It is also concluded that design criteria may, in some instances, be more appropriately based on the elevated temperature notched and unnotched properties of parent material, weld material, and the heat-affected zone, rather than just the unnotched parent material as provided for in the codes. (auth)

21777 NAA-SR-Memo-3416

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PREDICTED ORGANIC COOLANT ACTIVITY IN A CONTROLLED FUEL CLADDING DEFECT EXPERIMENT. M. Dunenfield. Nov. 26, 1958. 7p. $1.80 (ph), $1.80(mf) OTS.

A prediction is made of the ORME coolant activity which would result from operation of the reactor with an exposed fuel area. The variables considered include the length of reactor operation, the fuel area exposed, and fuel enrichment. (W.D.M.)

21778 NAA-SR-Memo-3419

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DISTRIBUTION OF POWER DENSITY IN THE PIQUA OMR. J. Hume. Jan. 16, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

Power density distributions were determined for several typical radial planes in the Piqua core. An axial distribution was determined for the case where the central control rod is completely inserted and the outer rods are inserted 66 cm for just critical. A clean core which was isothermal at 565°F was assumed. The peak-to-average power density factors were obtained. (auth)

21779 NAA-SR-Memo-4077

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRESSURE-DROP MEASUREMENTS OF THE 19-ROD URANIUM–MOLYBDENUM–5 SQ. IN. FUEL ELEMENT. D. M. Rosh. July 2, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

To substantiate calculations used in the design of the

HNPF reactor coolant system the actual pressure drop across the fuel element was determined. Using a full size mockup of the 19-rod Mo–U fuel element in a test loop with water as the hydraulic medium, pressure-drop measurements were taken across the inlet, exit, and fuel bundle of the fuel element assembly. The data obtained were converted to equivalent values for sodium through the use of density and viscosity ratios. Pressure losses for equivalent sodium flow rates for a peripheral and central element at reactor power levels varying between 10 to 100% of rated power are given. (auth)

21780 NAA-SR-Memo-4112
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HYDRAULIC TESTS OF METHODS OF DECREASING ANNULAR FLOW PAST AN SRE ORIFICE. R. J. Begley. July 14, 1959. 19p. $3.30(ph), $2.40(mf) OTS.

The effect upon annular flow rate of three labyrinth-wall configurations which were smooth, threaded, and grooved was investigated. Pressure-drop measurements were made across three labyrinth-type orifices attached to the bottom end of a mockup of an SRE 7-rod fuel element suspended in a simulated SRE process tube. Data were obtained using water as the test fluid and were converted to sodium at 550°F, which is the temperature assumed at the orifice. The by-pass flow at a constant orifice pressure drop around the cup-shaped orifices is compared with the standard SRE orifice plate. (auth)

21781 NP-7878
[Army Engineer Research and Development Labs., Fort Belvoir, Va.]
[HEAT EXCHANGER FOR PACKAGE POWER STUDY]. David Aronson. July 20, 1959. 5p.

A design is proposed for a compact heat exchanger for a light-weight power plant. (W.L.H.)

21782 ORNL-2759
Oak Ridge National Lab., Tenn.
A PRELIMINARY STUDY OF A DIRECT-CYCLE STEAM-COOLED REACTOR FOR MERCHANT SHIP PROPULSION. H. L. Falkenberry, R. S. Holcomb, and G. Samuels. Sept. 23, 1959. 18p. Contract W-7405-eng-26. $0.75(OTS).

A preliminary study was made of a steam-cooled, water-moderated reactor for a 20,000-shp power plant for a merchant ship. It appears that this plant is not attractive for marine applications because, for maritime service, the hazards associated with the use of radioactive steam in the propulsion and auxiliary machinery appear to outweigh the advantages of the direct cycle. This reactor type does have interesting possibilities for central-station applications, but considerable developmental work would be required. (auth)

21783 PRDC-TR-22
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] REPORT PERIOD APRIL 1959. 47p. Contract AT(11-1)-476. $7.80(ph), $3.30(mf) OTS.

The status of various research and development projects for the Fermi Fast Breeder Reactor is briefly summarized. (For preceding period see PRDC-TR-21.) (W.L.H.)

21784 TID-8508
Oak Ridge Operations Office, AEC.
TASK FORCE EVALUATION REPORT—SMALL-SIZED NUCLEAR POWER PLANT PROGRAM. June 1, 1959. 63p. $1.75(OTS).

The boiling water, pressurized water, and organic moderated reactor concepts are compared for selection of a reactor type suitable for immediate construction as a small-sized nuclear civilian power station. Estimated construction and operating costs are given for each concept. The selected concept is compared with estimated conventional plant costs in high cost fuel areas. The reactor concept recommended for construction is a pressurized, light water cooled and moderated unit employing slightly enriched UO_2 fuel and fossil fuel superheat coupled to a standard turbogenerator with a gross capability of 22 Mwe. (auth)

21785 TID-8509
Oak Ridge Operations Office, AEC.
GENERATING COOPERATIVES AND MUNICIPALITIES—STATISTICAL SURVEY. June 1, 1959. 42p. $1.25 (OTS).

Methods of gathering information are outlined, and statistics on units added in the past 5 years, unit costs, production costs, charges in municipalities, steam conditions, and capacity factors are analyzed. Data are tabulated and presented graphically. (J.R.D.)

21786 WAPD-BT-14
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. July 1959. 164p. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. $3.00(OTS).

Thirteen papers are included. Separate abstracts have been prepared for each paper. (W.L.H.)

21787 WAPD-BT-14(p.1-7)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ESTIMATION OF STRESSES IN PERFORATED SPHERICAL PRESSURE VESSEL CLOSURES. B. F. Langer and H. Kraus. p.1-7 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 7p.

There is no exact method available for the determination of stresses in a perforated pressure vessel head. To obtain experimental information on this problem, photoelastic tests were performed on a series of models of Bettis Plant pressure vessel head designs. A method for the estimation of the stresses in perforated pressure vessel closures was developed from the data gathered in these tests and is described. (auth)

21788 WAPD-BT-14(p.8-14)
Westinghouse Electric Corp. Research Labs., Pittsburgh.
PHOTOELASTIC STUDY OF STRESS IN PERFORATED HEMISPHERICAL CLOSURES FOR A PRESSURE VESSEL. R. C. Sampson and M. M. Leven. p.8-14 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 7p.

Photoelastic "frozen stress" tests were performed on perforated hemispherical closures for a pressure vessel; three different hole patterns were investigated. The "circular" and "square" arrangements of holes showed the highest peak stress, a value of stress + pressure of about 10 being noted in both. In comparison, the "triangular" arrangement of holes yielded a peak stress per unit pressure value of 8.20. (auth)

21789 WAPD-BT-14(p.15-24)
Westinghouse Electric Corp. Research Labs., Pittsburgh.
EFFECT OF CAP RIGIDITY ON STRESSES IN A PERFORATED HEMISPHERICAL HEAD. R. C. Sampson.

p.15-24 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 10p.

A flanged hemispherical head with a circular arrangement of 13 holes was tested by the photoelastic "frozen stress" technique; hole caps of three different rigidities were employed and found to have a pronounced effect on the maximum stresses in the vicinity of the holes, but little effect at a short distance from the holes. The maximum stress at the boundary of a hole, not reinforced by a cap, was determined by extrapolation to be as much as 15 times the internal pressure, this peak stress occurring at the inner surface of the hemisphere in the narrowest section of a ligament between holes. Holes with very rigid caps, not attached near either surface of the hemisphere, may show a maximum stress that is only about 10 times the internal pressure. (auth)

21790 WAPD-BT-14(p.25-32)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. EVALUATION OF LUMPED MASS APPROXIMATIONS FOR THE VIBRATIONS OF CONTINUOUS STRUCTURES—A STUDY. S. J. Becker. p.25-32 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 8p.

The flexural vibration equation is examined and some important differences between solutions to this and the wave equation of second order are shown, including change of shape of the wave in propagation, dependence of wave velocity on frequency, and non-uniform spacing of frequencies. Then, finite difference and lumped mass approximations to the flexural vibration equation are evaluated as well as the magnitude of the error of these approximations. Finally, the energy equation of the lumped mass approximation is found and the error of this expression is evaluated. (auth)

21791 WAPD-BT-14(p.33-45)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. AN ANALYSIS OF A CYLINDER FLANGE OF STEPPED SECTION UNDER INTERNAL PRESSURE. S. J. Becker. p.33-45 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 13p.

The application and extension of the analysis of the Timoshenko ring to a section of non-rectangular shape, under the restraint of one or more cylinders and under the action of internal pressure, are discussed. A reasonable theoretical approach is indicated as well as a seemingly erroneous but rational approach. Application to the support ring of the S-130 Spent Fuel Shielded Shipping Container is presented as an example. (auth)

21792 WAPD-BT-14(p.46-59)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ANALYSIS OF THERMAL DISTORTION OF CONTROL RODS. W. R. Mendes. p.46-59 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 14p.

A detailed report of this study is available as WAPD-PWR-(RD2)-229, dated Oct. 1958.

This study was undertaken for the express purpose of obtaining analytical procedures which would adequately predict the distortion in reactor control rods. Such a procedure based on elastic theory has been developed and correlated with available test data, the results of which are to be found in this paper. The results of the correlation indicate that the approximate equations which have been derived can be readily applied to rods with +, Y, H, and similar cross sections which can be broken down into basic solid sections, analyzed, and recombined. (auth)

21793 WAPD-BT-14(p.60-5)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. DETERMINATION OF COMPONENT SAFETY DURING CYCLIC THERMAL CONDITIONS. J. D. Cohen. p.60-5 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 6p.

Piping system components must be designed to accommodate the high stresses introduced by cyclic thermal conditions. Curves are developed which should aid the system designer in determining the safety of his system. The limitations of these curves are also presented. (auth)

21794 WAPD-BT-14(p.66-74)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. RELAXATION AND RESIDUAL STRESS IN BENT SHAPES. M. J. Manjoine. p.66-74 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 9p.

Residual stresses are introduced in reactor coolant pump shafts when straightened or formed by plastic bending. Consequently, an investigation was initiated to determine the deflections which occur with the relaxation of such stresses. From an analysis of the results, a straightening procedure having wide application was formulated and recommended for round shafts. (auth)

21795 WAPD-BT-14(p.75-93)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. THE WAPD-SPERT-1 EXPERIMENT. E. R. Sanford. p.75-93 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 19p.

To determine the self-shutdown properties of heavily-loaded U–Zr fuel plates, as utilized in critical assemblies, a series of power transients was conducted with the SPERT-1 reactor containing some U–Zr plates. Temperatures and pressures during the transients were obtained to determine the relative self-shutdown properties of the SPERT fuel plates on the U–Zr fuel plates. The results indicated that the self-shutdown properties of the U–Zr plates could be calculated with reasonable accuracy and that they were adequate for use in critical assemblies without undue hazard. (auth)

21796 WAPD-BT-14(p.94-104)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. NEUTRON AND GAMMA SOURCE STRENGTHS FROM IRRADIATED RADIUM–BERYLLIUM SOURCES. D. J. Dudziak. p.94-104 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 11p.

This discussion reviews the characteristics of irradiated radium neutron sources which show considerable promise for use as reactor start-up sources. Expressions are derived for the variation of the neutron and gamma source strength, pertinent nuclear data are provided, and a digital computer solution is programmed. The variations of the source constituent nuclides with time are plotted for representative MTR-ETR thermal neutron fluxes, and gamma yields are tabulated for each nuclide's decay chain. (auth)

21797 WAPD-BT-14(p.105-19)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. THERMAL ANALYSIS OF THE EFFECT OF AXIAL FLUX DISTRIBUTION ON STEADY-STATE PERFORMANCE OF NUCLEAR REACTORS. J. S. Williams, Jr. p.105-19 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 15p.

An analysis of steady-state reactor performance was made to aid in design improvement. The analysis covered variations in axial flux distribution, thermal conductivity, and film coefficient, in combination with existing thermal design criteria. The results indicated that significant improvements in operating flux levels may be achieved by optimizing the axial flux distribution with respect to the governing criteria. (auth)

21798 WAPD-BT-14(p.120-41)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
STEAM JET PUMP OPERATION AT HIGH PRESSURES. S. G. Margolis. p.120-41 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 22p.

Steam jet pumps are simple, rugged devices which offer an attractive means for circulating water in closed pressurized loops. These pumps were tested using steam at 950, 1200, and 1500 psia. Pump performance was found to correlate well with calculations based upon an effective diffuser efficiency and an empirical relationship between throat pressure and pump inlet subcooling. (auth)

21799 WAPD-BT-14(p.142-55)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TRANSFER FUNCTION TECHNIQUES FOR THERMAL SYSTEM TRANSIENT ANALYSIS. E. Quandt. p.142-55 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 14p.

Recently, it has become necessary to provide a method for analyzing the transient time response of some relatively simple thermal systems. Since these systems obey a set of linear differential equations, the Laplace transform and transfer function methods are presented as a technique for evaluation. Procedures are outlined for the analytical and experimental determination of system transfer function, input, or output, and the manner in which any two of these factors may be used to determine the third. (auth)

21800 WAPD-CDA(AD)-528
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE PERFORMANCE OF BASE-FORM ION EXCHANGERS FOR pH CONTROL AND REMOVAL OF FISSION PRODUCTS FROM PRESSURIZED WATER REACTORS. G. P. Simon, C. S. Abrams, W. T. Lindsay, Jr. [Apr. 1959]. 114p. Contract [AT-11-1-GEN-14]. $18.30(ph), $6.00(mf) OTS.

Laboratory experiments and in-pile loop tests designed to evaluate, explain, and predict the performance of mixed-bed ion exchange columns in the base form for control of pH and removal of radioisotopes from reactor coolant are summarized. The results of the tests are evaluated with the aid of a simple theory of column performance for absorption of radioactively decaying ions, based on an approximate model for an ion exchange column. It is concluded that LiOH-form resin will perform satisfactorily for both pH control and activity removal. The results indicate that LiOH resin is more effective than either KOH resin or NH_4OH resin for these purposes. (auth)

21801
LONG TERM REACTIVITY CHANGES. H. Rose and J. J. Syrett (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 4, 179-83(1959) July.

The changes in reactivity of a power reactor due to irradiation are of great importance in designing a reactor for economic power production. Long term reactivity changes are discussed for natural, or near natural, uranium thermal reactors. Due to inadequacies in basic nuclear data and methods of calculation, purely theoretical predictions from fundamental data are subject to large uncertainties. In addition to fundamental nuclear data, accurate estimates of long term reactivity changes require estimates of the neutron spectrum in the fuel of reactors, and measurements on irradiated fuel elements, obtained by the pile oscillator technique, and from chemical and mass spectrometric analyses. By correlating such integral measurements with predictions made on the basis of a relatively simple model of neutron behavior, the basic data can be adjusted to give agreement of predictions and the measurements. These adjusted data, together with the same model of neutron behavior, can then be used to obtain more reliable predictions of reactivity changes in power reactors. Further improvements in accuracy require measurements on plutonium-fuelled lattices. Typical predictions are given of the variation of reactivity with irradiation, showing the relative importance of the various changes which occur in the fuel, and the effect of changes in reactor parameters. From such estimates the change of reactivity of an entire reactor for a given fuel cycle can be predicted by integrating over all fuel in the reactor. This information, together with consideration of failure of fuel due to metallurgical damage caused by irradiation, can then be used to optimize the fuel cycle. (auth)

21802
NUCLEAR STEAM GENERATOR. (to Babcock and Wilcox Co.). British Patent 820,466. Sept. 23, 1959.

A homogeneous pressurized-water reactor is described. (T.R.H.)

STABLE ISOTOPE SEPARATION

21803 NYO-699
New York Operations Office, AEC.
STATUS REPORT ON HEAVY WATER PRODUCTION PROGRAM. DESIGN OF PRODUCTION PLANT—HYDROGEN DISTILLATION PROCESSES, HYDROCARBON RESEARCH, INC., CONTRACT AT(30-1)-810. DESIGN OF PILOT AND PRODUCTION PLANT AND CONSTRUCTION OF PILOT PLANT—DUAL-TEMPERATURE PROCESS, THE GIRDLER CORPORATION, CONTRACT AT(30-1)-947. June 19, 1950. Decl. Jan. 15, 1959. 64p. $10.80(ph), $3.90(mf) OTS.

Time schedules and costs are presented for the construction of the hydrogen-distillation and dual-temperature plants for the production of heavy water. Process flowsheets and material flowsheets are presented for the Hydrogen Distillation Heavy Water Plant. A review of the progress on design of the plant is also included. Progress is also reported on the Dual-temperature Process. Flowsheets of the process are included. (W.L.H.)

21804 NYO-6085(Rev.)
Esso Research and Engineering Co., Linden, N. J.
DEUTERIUM SEPARATION STUDY. Progress Report No. 2. W. P. Drewe. Aug. 1, 1955. Decl. Mar. 4, 1957. 77p. Contract AT(30-1)-1407. $12.30(ph), $4.50(mf) OTS.

Three processes were studied for the separation of deuterium: Low-Temperature Char Adsorption of Hydrogen, Water/HI in Dual-Temperature Exchange, and

Direct Electrolytic Release of Deuterium from Water. Other processes are also reported. These processes were evaluated from an economic standpoint. (W.L.H.)

21805 ORNL-2631(Del.)
Oak Ridge National Lab., Tenn.
STATUS OF DEVELOPMENT OF THE ZIRCEX PROCESS. J. J. Perona, J. B. Adams, J. E. Savolainen, and T. A. Gens. Mar. 31, 1959. Decl. with deletions July 24, 1959. 61p. Contract W-7405-eng-26. $10.80 (ph), $3.90(mf) OTS.

The Zircex Process is a chemical method for separating zirconium and uranium by reacting spent fuels with anhydrous hydrogen chloride at >500°C, producing volatile zirconium tetrachloride and a nonvolatile uranium-containing residue. The hydrochlorination step was found feasible from the chemical and engineering viewpoints. Reaction times for fully enriched fuel assemblies would probably be less than 10 hr and for decladding UO_2-containing fuels less than 3 hr. For the thick plate Experimental Boiling Water Reactor fuel assemblies, reaction times of 30 hr or more would probably be required. Glass wool filters packed to a density of about 0.35 g/cc kept uranium losses to the $ZrCl_4$ sublimate below 0.1% for all fuels. Unirradiated fuel specimens were used, except for a single tracer-level run. A satisfactory method for the condensation of highly radioactive $ZrCl_4$ has not yet been developed. (auth)

21806 TID-5337
Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Augusta, Ga.
DW PLANT OPERATING CHARACTERISTICS. J. A. Blair. June 18, 1954. Decl. Mar. 6, 1957. 47p. (DPSP-54-25-7). $7.80(ph), $3.30(mf) OTS.

DW plant characteristics are defined by graphic correlation of process variables such as feed rate, drawoff rate, feed concentration, drawoff concentration, and feed plate. (J.R.D.)

21807 CEA-tr-A-577
SÉPARATION QUANTITATIVE DES ISOTOPES DE L'HYDROGÈNE PAR DÉSORPTION FRACTIONNÉE. (Quantitative Separation of Hydrogen Isotopes by Fractionated Desorption.) K. Peters and W. Lohmar. Translated into French from Z. physik. Chem. (Leipzig) 180A, 51-7(1937). 12p.

The separation of hydrogen isotopes by fractional desorption from activated carbon at low temperatures was investigated. The hydrogen mixture was adsorbed at liquid air temperatures and the temperature was then raised. The molecular weight of the first two fractions desorbed from the carbon was that of H_2. The third fraction showed an increase in weight which corresponded to 36.5% HD. The fourth fraction corresponded to 93.5% HD and 6.5% D_2, with no H_2. (J.S.R.)

21808
PROGRESS IN DISTILLATION TECHNOLOGY. M. E. Aerov and V. A. Malyusov. Khim. Nauka i Prom. 3, 736-45(1959) Jan.

Particular attention is paid at present to the production of deuterium by the rectification of liquid hydrogen, because this method is regarded as being potentially of greater advantage from the economic standpoint than other known methods. In addition to the investigation of processes for the separation of hydrogen isotopes by distillation with the use of laboratory columns, experimental and industrial installations for the rectification of liquid hydrogen are being built in France, Western Germany, the US, and India. The greatest progress in the development of this complicated method has apparently been made in the USSR, where an industrial installation for the separation of hydrogen isotopes by the rectification of liquid hydrogen has already been in operation for a long time.

21809
SEPARATION OF POTASSIUM ISOTOPES BY EVAPORATION FROM POTASSIUM MELT IN VACUUM. B. P. Constantinov and B. S. Rylov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 784-90(1959) June. (In Russian)

Under ideal evaporation conditions the separation factor for potassium isotopes is $\alpha = 1.024(4) \pm 0.0010$. Within the limits of error, this is close to the calculated separation coefficient: $\alpha_{max} = 1.0258$. The coincidence of α magnitudes indicates the liquid potassium phase does not form molecules. The separation factor depends on the rate of evaporation, therefore, insufficient mixing of the melt reduces the isotopic effect. (R.V.J.)

21810
METHOD OF SEPARATING NITROGEN ISOTOPES BY ION-EXCHANGE. Frank H. Spedding and Jack E. Powell (to Iowa State College Research Foundation). U. S. Patent 2,889,205. June 2, 1959.

Separation of N isotopes on a cation exchange resin column is described in a NH_4^+ band with a sharp front boundary. Successive elutions with alkali metal hydroxide behind the band give a sharply defined rear edge to the band and move it along the column. N^{15} concentrates at the front edge. (T.R.H.)

TECHNOLOGY

Feed Materials

21811 NLCO-722
National Lead Co. of Ohio, Cincinnati.
EVALUATION OF THE MOVING BED REACTOR PROCESS FOR THE PRODUCTION OF URANIUM TETRAFLUORIDE; TERMINATION REPORT. Donald J. Loudin. Feb. 12, 1958. 91p. Contract AT(30-1)-1156. $2.25(OTS).

The design of a moving bed reactor green salt plant here presented is based on design criteria developed by pilot plant operation. Comparison of the operating and investment costs for this design with those for a previously designed plant indicates that the moving bed reactor process remains economically feasible. Technical problems meriting further investigation are enumerated. (auth)

21812 NLCO-788
National Lead Co. of Ohio, Cincinnati.
THE PREPARATION OF METAL GRADE UF_4 FROM SCRAP BY THE WINLO PROCESS. Earl O. Rutenkroger and John H. Cavendish. June 8, 1959. 36p. Contract AT(30-1)-1156. $1.00(OTS).

An amine extraction flowsheet has been developed in the laboratory which will purify low-grade MgF_2-type scrap sufficiently for precipitation of metal-grade UF_4 by the Winlo aqueous precipitation process. An alternative scrap treatment process, the currently used UAP precipitation, was found to give sufficient purification so that the UAP could be dissolved in hydrochloric acid and metal-grade UF_4 precipitated from this solution by the Winlo process. Several of the high-grade black-

oxide scrap streams were found to be sufficiently pure to be amenable to a hydrochloric acid dissolution-aqueous UF_4 precipitation process without prior purification. Scale-up of the aqueous UF_4 precipitation process from beaker scale to pilot scale has been successfully accomplished. Decontamination factors for various elements during precipitation were determined. (auth)

21813

RECOVERY OF URANIUM FROM LOW GRADE URANIUM BEARING ORES. Harrison B. Rhodes, William F. Pesold, and Jack M. Hirshon (to U. S. Atomic Energy Commission). U. S. Patent 2,890,099. June 9, 1959.

Recovery of U, Fe, and Al from Chattanooga shale is described. Ground shale (−4 to +325 mesh) is roasted to remove organic and volatile matter. The heated shale is then reacted with a chlorinating agent (CCl_4, $COCl_2$, Cl, and SCl) at 600 to 1000°C. The metal chloride vapor is separated from entrained solids and then contacted with a liquid alkali metal chloride which removes U. The U is recovered by cooling and dissolving the bath followed by acidification and solvent extraction. A condensed phase of Al, Fe, and K chlorides is treated to separate Al as alumina by passing through a Fe_2O_3 bed. The remaining $FeCl_3$ is oxidized by O_2 at 1000°C to form Fe_2O_3 and Cl_2. Alternatively, vapor from the U separation step may be passed to a liquid KCl bath at 500 to 650°C. The resulting mixture is oxidized to form Cl_2 and $Fe_2O_3 + Al_2O_3$. The Al and Fe are separated by reaction with NaOH at high temperatures and pressures. (T.R.H.)

Raw Materials

21814 K-1378

Oak Ridge Gaseous Diffusion Plant, Tenn.

PILOT-PLANT REDUCTION OF URANIUM HEXAFLUORIDE WITH HYDROGEN OPERATING MANUAL. J. J. Kurtz, R. H. Nimmo, S. Campanella, and R. P. Smith. Apr. 29, 1958. Decl. Aug. 21, 1959. 100p. Contract W-7405-eng-26. $15.30(ph), $5.40(mf) OTS.

A continuous process for the reduction of uranium hexafluoride to uranium tetrafluoride with hydrogen has been developed and proved on a pilot-plant scale. To evaluate operating, maintenance, and uranium material balance problems, an improved experimental facility has been designed and constructed. Detailed descriptions of the equipment, the flows and controls, and the operating and maintenance procedures are presented. (auth)

21815

METALLURGICAL PROCESSING OF URANIUM ORES. Roger Dering. U. S. Patent 2,890,795. June 16, 1959.

A process for concentrating U values in ores before processing for U recovery is offered. Raw ore is crushed in rubber-lined equipment and wetted to prevent dust loss. The crushed ore passes then to an attrition mill where it is conditioned for the first flotation (coal tar creosote collector-pine derivative frothing reagent) to remove carbonaceous material. The tailings go through a scouring and abrading stage which separates sands and slimes. The sands, preserved largely in their original condition, are classified and gravity concentrated, rejects being ground and slimed. The slimes are thickened, resurfaced with a metallic coating, activated, and subjected to another flotation to recover a U-containing float concentrate. The particular advantage in this process is that precise control by technically trained operators is not necessary. (T.R.H.)

21816

RECOVERY OF URANIUM VALUES FROM URANIUM BEARING RAW MATERIALS. Eugene J. Michal and Robert R. Porter (to U. S. Atomic Energy Commission). U. S. Patent 2,890,933. June 16, 1959.

Uranium leaching from ground uranium-bearing raw materials using MnO_2 in H_2SO_4 is described. The MnO_2 oxidizes U to the leachable hexavalent state. The MnO_2 does not replace Fe normally added, because the Fe complexes P and catalyzes the MnO_2 reaction. Three examples of continuous processes are given, but batch operation is also possible. The use of MnO_2 makes possible recovery of very low U values. (T.R.H.)